Trail Layout and Design

Today's Activities

- Morning Lectures
  - Design Concepts
  - Layout Principles

Trail Layout and Design Days Activities

Morning Lab Activity

- Abney Hand Level and Clinometer Orientation

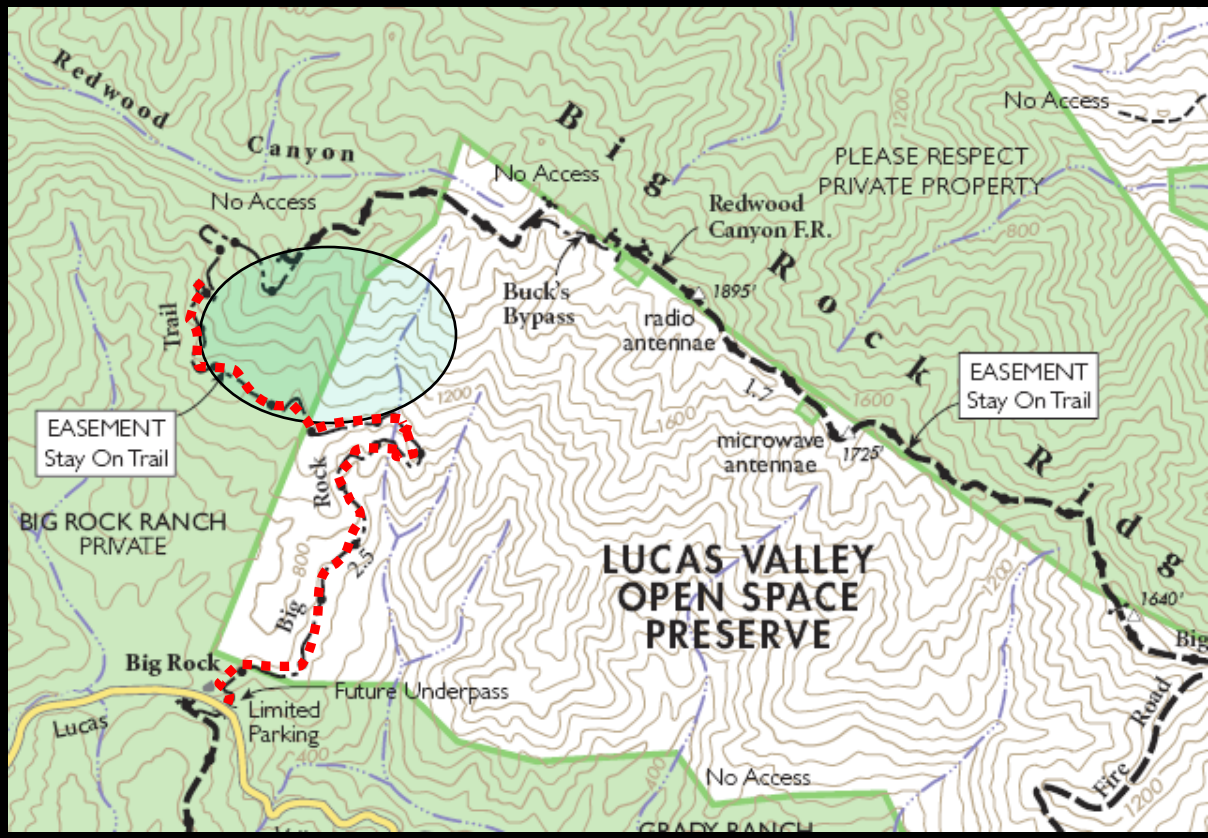
Trail Layout and Design Days Activities

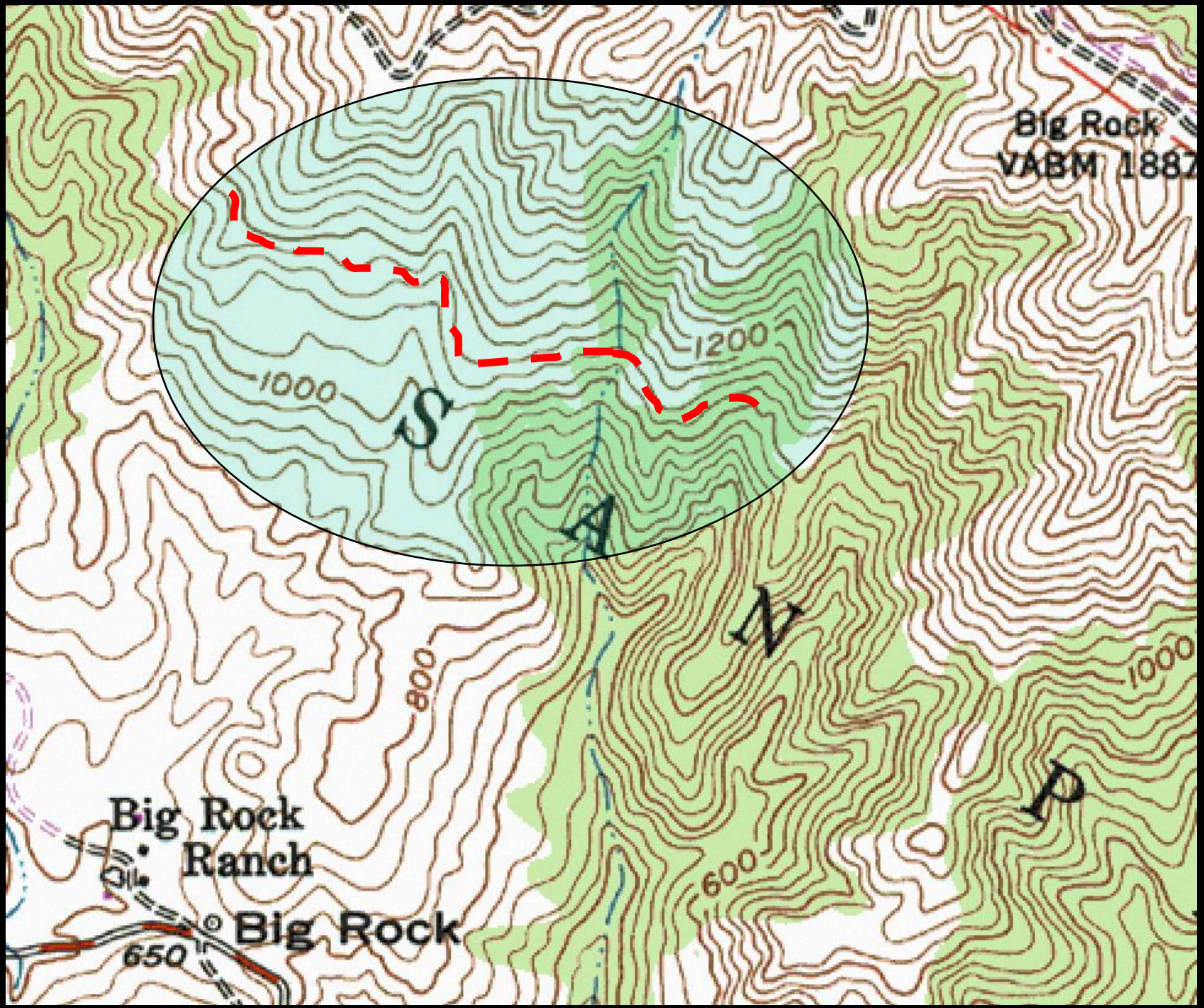
Afternoon Lab Activity

- Afternoon 4 Hour Lab

  Big Rock Trail

  Marin Open Space District



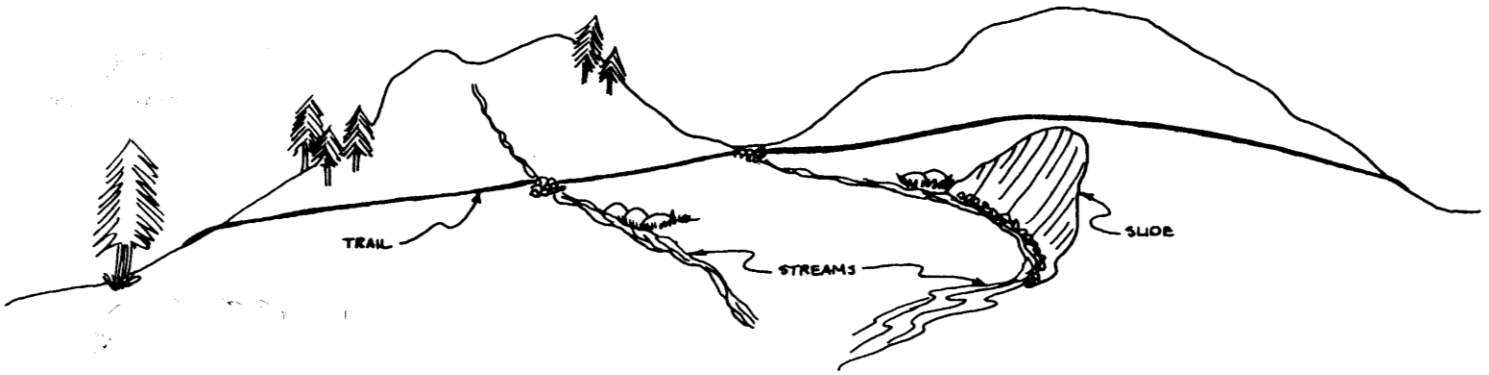

Big Rock
VABM 1887
1200
1000
S
A
N
P
800
1000
600
Big Rock
Ranch
Big Rock
650

Trail Layout and Design
Lab Activity

- Task Hazard Analysis

Ticks

Sustainable Trail Design



TOPOGRAPHIC PROFILE OF TRAIL LAYOUT NOT TO SCALE

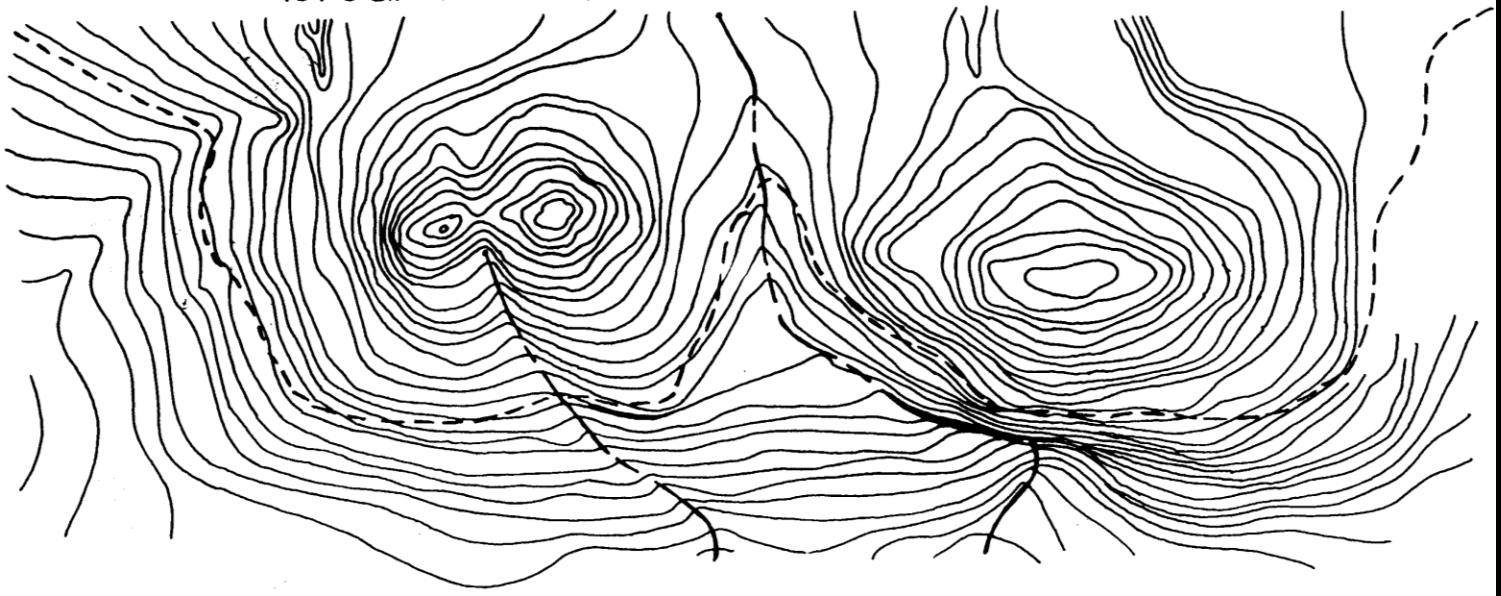


Figure 10.3

RELATIONSHIP OF TOPOGRAPHY TO TRAIL GRADE AND LAYOUT

Sustainable Trail Design Objectives

- Define What is Sustainable Trail Design
- Learn How Types of Users, Trail Classes and Standards Effect Design
- How The Planning and Information Gathering Process Affects Design
- The Need to Establish Major and Minor Control Points in Trail Corridors
- Learn How to Break the Trail Corridor Into Manageable Units
- The Importance of Reconnaissance
- How to Design for Land Capability, Aesthetics, and Safety Concerns
- The Need for Resource Specialists Review Before Flagging a Trail Alignment

Why Sustainable Trails?

Consider the Life of a Trail

Trail Layout and Design

Construction

Maintenance

Every Land Management Agency Has Their Own Mission That Guides Them

MISSION STATEMENT

BLM

The Bureau of Land Management is responsible for stewardship of our public lan
BLM is committed to manage, protect and improve these
needs of the American people. Management is based upon
sustained yield of our nation's resources within a framework
and scientific technology. These resources include recreation, rangelands, timber
watershed, fish and wildlife habitat, wilderness, air and scenic quality, as well as s
cultural values.

NATIONAL SYSTEM OF PUBLIC LANDS

Subsistence Mission Statement and Law

In 1980, an unprecedented bill was signed into law. The Alaska National Interest Lands Conservation Act, commonly known as ANILCA, set aside approximately 100 million acres of land and resources for enduring protection throughout Alaska. It tripled the size of Mt. McKinley National Park, and the area was re named "Denali National Park and Preserve. "

This legislation recognizes the important connection between local rural subsistence users and the land. In Denali, as long as fish and wildlife resources and their habitats are maintained in a natural and healthy state, traditional subsistence hunting, trapping and fishing are allowed in the 1980 ANILCA park and preserve additions.

To ensure the continuation of th engage in the subsistence use of resources in Denali, the Nationa he following mission statement to guid its activities. Subsistenc e consistent with the provisions of ANILCA

(Section 202(3)) , the Organic egislation to:

- protect the opportuni o continue traditional subsistence activities;
- recognize that subsis to region and are continuing to evolve, and where app s may reflect regional diversity and evolution;
- promote local involvement and participation in processes associated with subsistence management;
- ensure that management practices involving the utilization of public lands adequately consider the potential for restriction of subsistence uses and impacts upon subsistence resources;
- ensure that management of park resources is consistent with the conservation of unimpaired ecosystems and natural and healthy populations of fish and wildlife, incorporating scientific data and principles with traditional knowledge and cultural values; and

DNR's Mission:

To develop, conserve a tural resources for present and future

WHAT WE DO

Mission Statement

Working for the Great Outdoors!

The Forest Service mission is captured by the phrase "Caring for the Land and Serving People." Our mission, as set forth by law, is to achieve quality land management under the sustainable multiple-use management concept to meet the diverse needs of people. For Forest Service employees this means participating in the follow activities:

- Advocating a c omoting the health, productivity, di forests and associated lands.
- Listening to pec their diverse needs in making decisior
- Protecting and forests and grasslands so that they be stainable multiple-use management c
- Providing techn ance to State and private forest landowners, encouraging them to practice good stewardship and quality land management in meeting their specific objectives.
- Providing international technical assistance to cities and urban communities to improve their natural environment by planting trees and caring for their forests.
- Helping States and communities to use the forests wisely in order to promote rural economic development and a quality rural environment.
- Developing and providing scientific and technical knowledge aimed at improving our capability to protect, manage, and use forests and rangelands.
- Providing work, training, and education to the unemployed, underemployed, elderly, youth, and disadvantaged in pursuit of our mission.

National Park Service Mission Statement

On August 25, 1916, President Woodrow Wilson signed the act creating the National Park Service, a new federal bureau in the Department of the Interior responsible for protecting the 40 national pa n in existence and those yet to be established.

This "Organic Act" of Augus the Service thus established shall promote and regulate the use n as national parks, monuments and reservations . . . by such mea nform to the fundamental purpose of the said parks, monuments a purpose is to conserve the scenery and the natural and historic c therein and to provide for the enjoyment of the same in suc means as will leave them unimpaired for the enjoyment of future g

The National Park Service still strives to meet those original goals, while filling many other roles as well: guardian of our diverse cultural and recreational resources; environmental advocate; world leader in the parks and preservation community; and pioneer in the drive to protect America's open space.

ALASKA TRAILS

Mission: To enhance the Alaska trail experience by supporting sustainable, world-renowned trails through advocacy and education.

Alaska State Trails Program

Alaska Department of Natural Resources, Division of Parks and Outdoor Rec.

To promote the health, social and economic benefits of trails By educating users through forums, conferences, information materials, training and other activities.

To preserve and improve public By assisting public and priva s, policies, and standards.

To promote sustainable trail syst By developing and providing

Recent Accomplishments

- Sponsored the Alaska Statewid
- Sponsored IMBA Trail Trainin y and Fairbanks in 2004 and 2005.
- Produced and distributed a DV dissate presentation in 2006.
- Developed Introductory Trail T orkers in 2006.

Ongoing Activities

- Maintaining a web site (http:/ ial issues and resources.
- Maintaining a statewide email
- Producing and distributing a q
- Providing sustainable trail desi projects in Bethel, Anchorage (2), Fairbanks, Chi ley
- Teaching Introductory Trail T banks (Apr), Kodiak (Jun), Wasilla (Sep), and Girdw
- In cooperation with U.S. Bureau of Land Management, producing an OHV/ATV Safety & Ethics Program for statewide distribution to elementary through high school classes.
- Developing curriculum modules for advanced trail-training topics.
- Designing and producing a *Trails & Health* brochure.
- Acting as a "funding pass-thru" for smaller trail organizations not established as nonprofits.
- Trail training and resource management MOUs signed with the U.S. Forest Service, U.S. National Park Service, and Alaska State Parks.
- Developing a list of and linking trail organizations across the state, their contact information, and posting on our web site.

Alaska State Parks

They Also Have Specific Land Management Classifications & Policies That Determine The Type Of Use That Can Occur on Their Lands

What Is A Sustainable Trail?

- A trail that has been designed and constructed to a standard that it does not adversely impact natural and cultural resources
- Can withstand the impacts of the intended user and the natural elements while receiving only routine cyclic maintenance
- Meets the needs of the intended user to a degree that they do not deviate from the established trail alignment.

Impacts that would be considered “take” are avoided and impacts that are considered “sensitive” are mitigated through the planning and environmental review process

Sheet flow runoff is not diverted or accumulated and is allowed to continue on its normal flow path. All drainages (including micro drainages) are not captured, diverted or coupled with other drainages by the trail. Water is not accumulated on the trail and drained off onto the landform where natural drainages do not exist.

Are designed and constructed to withstand the impacts of 25 to 100 year storm events. The trail tread and structures will be unaffected by these events.

Trail design and user group satisfaction results in the intended user group staying on the designated trail alignment and not creating unauthorized way or volunteer trails

The level of user satisfaction also results in the continued use of the trail with no significant reduction of trail usage

Identify the Trail User

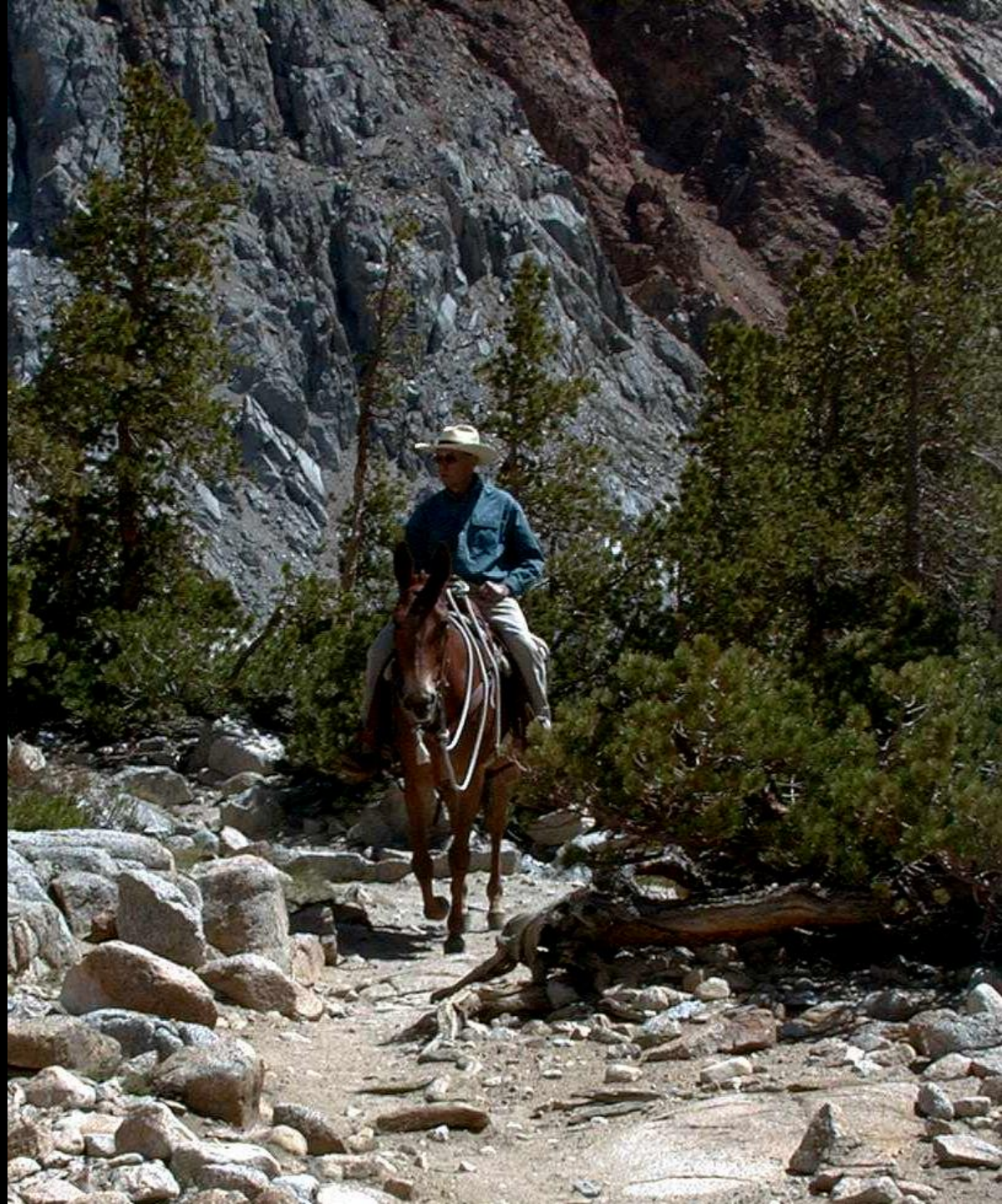
New Outdoor Access Guidelines for Trails

New or Altered Trails May Need to Comply

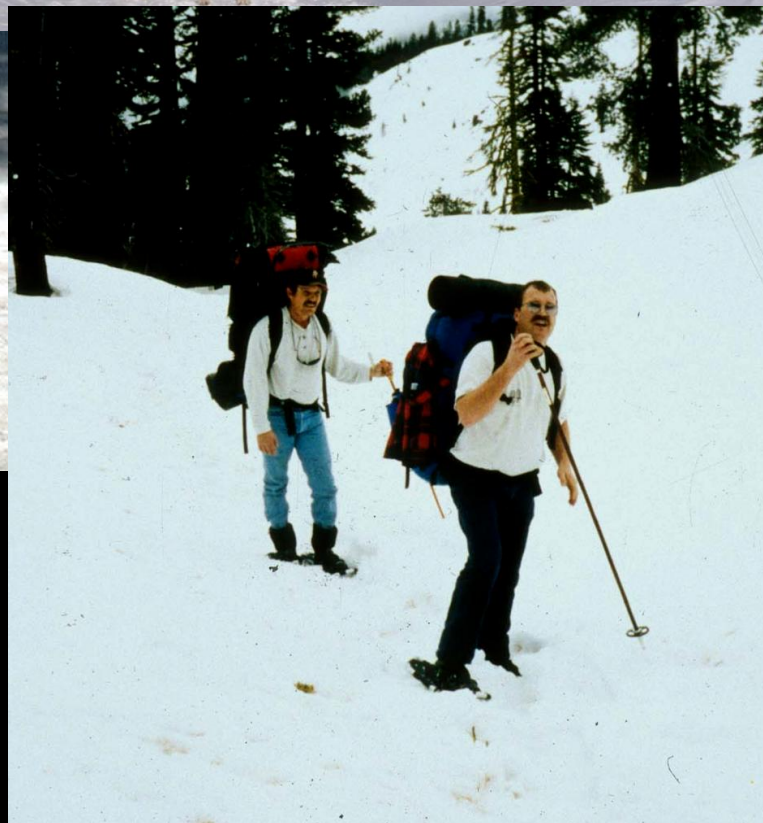
Hikers and Backpackers

Mountain Bikers

Equestrians



Multiple Users Groups



Winter Users

Motorized

Non Consumptive & Consumptive Trail Uses

- Non consumptive trail use places the emphasis of the user experience on the “setting” rather than the mode of travel.
- Sustainable trail design and construction techniques are used to preserve the environment and retain the “sense of place”

Consumptive Trail Use

- **Consumptive trail use places the emphasis of the user experience on the mode of travel or locomotion**
- **The increased user impacts or the modified trail design and construction techniques associated with this use is mitigated by additional trail structures and or increased construction and maintenance cost.**

Consumptive Trail Use

- **The difference isn't just the rate of mechanical wear but the "experience" the user is seeking that ultimately increases the rate of mechanical wear.**
- **When the ride or mode of traveling across the trail becomes as important or more important than the experience of being in the "setting" then the use becomes consumptive.**
- **These types of trail uses must be consistent with the mission, policies and restrictions of the park classification and/or the land management agency.**

Identify the Trail Classification

Trail Classification Matrix

Determines Objective Level of Use

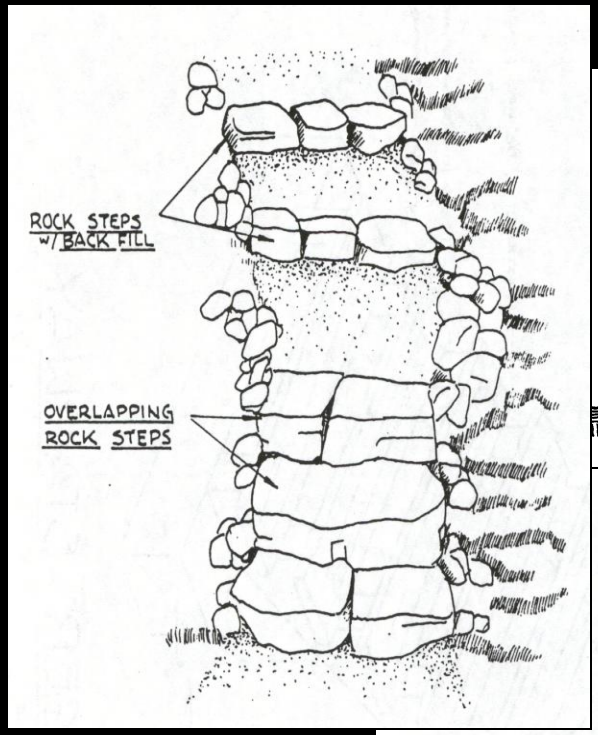
TRAIL NAME: _____

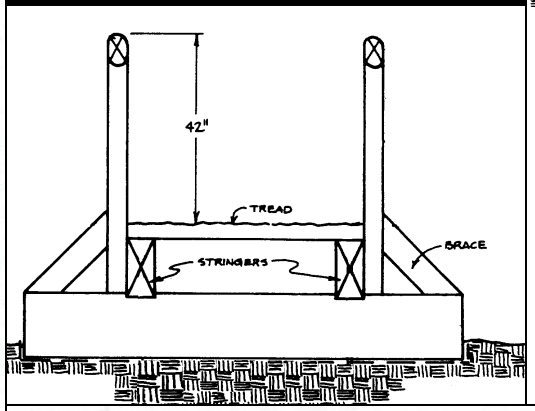
TRAIL CLASSIFICATION MATRIX

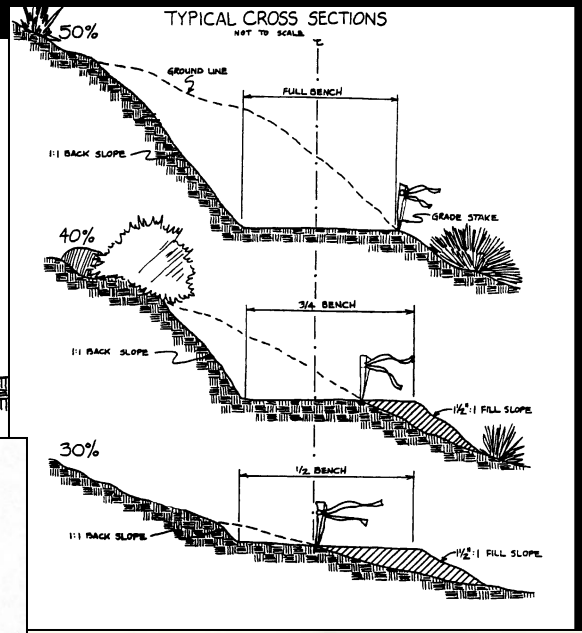
CRITERIA	Point Values	Rating
1. Accessible	25	
2. Interpretive	15	
3. Within Visitor Use Facility	15	
4. Equestrian and Bike (Multi Use)	15	
5. Adjacent to Visitor Use Facility		
0-1/4 mile	12	
1/4 - 1 mile	8	
1-2 mile	4	
2 or more miles	0	
6. Connection of Visitor Use Facilities	5	
7. Parking Access	5	
8. Destination Oriented		
0 - 1 mile	3	
1 -3 miles	2	
3 + miles	1	
9. Connection with Other Agency Trail	+3 - +5	
10. Special Use or Access	1	
11. Dead End Trail	0 or -3	
12. Loop or Connecting Trail	+1 - +3	
13. Fragile Environment		
Protected by lessening use	-1 - -3	
Protected by upgrading	+1 - +3	
14. Safety Factors		
a. Encourage less use by not Providing Improvements	-1 - -5	
b. Provide and maintain improvements	+0 - +5	
15. Staff Determined Use Patterns		
Little or no use	-1 - -3	
Higher use	+1 - +3	
	TOTALS	

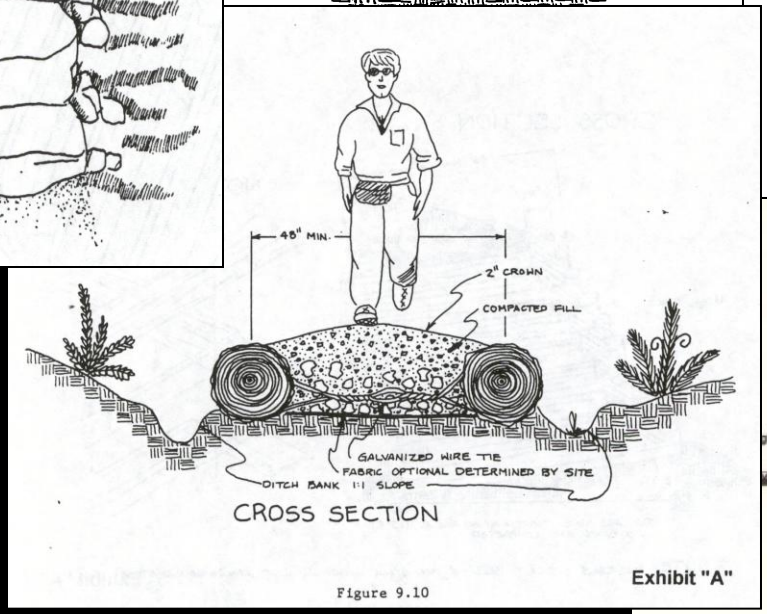
CLASSIFICATION: II
I = 30+
II = 19 - 29
III = 10 - 18
IV = 0 - 9

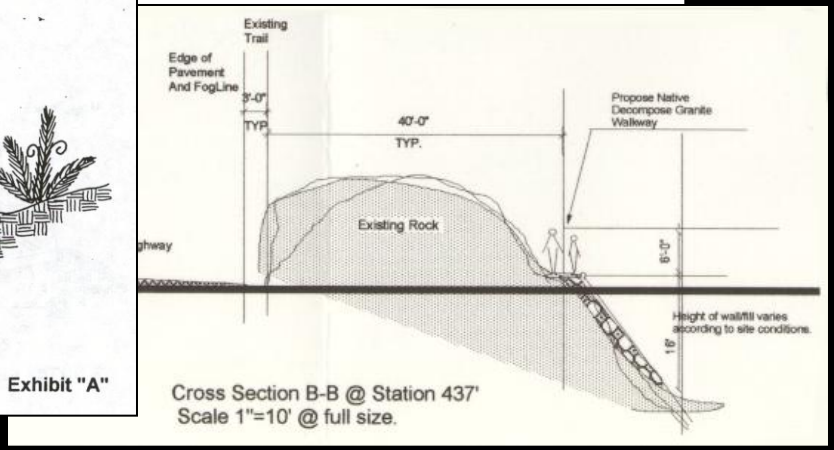
Figure X











Determine Specifications & Standards – Based on User Group, Classification and Season of Use

Identify Points of Connection

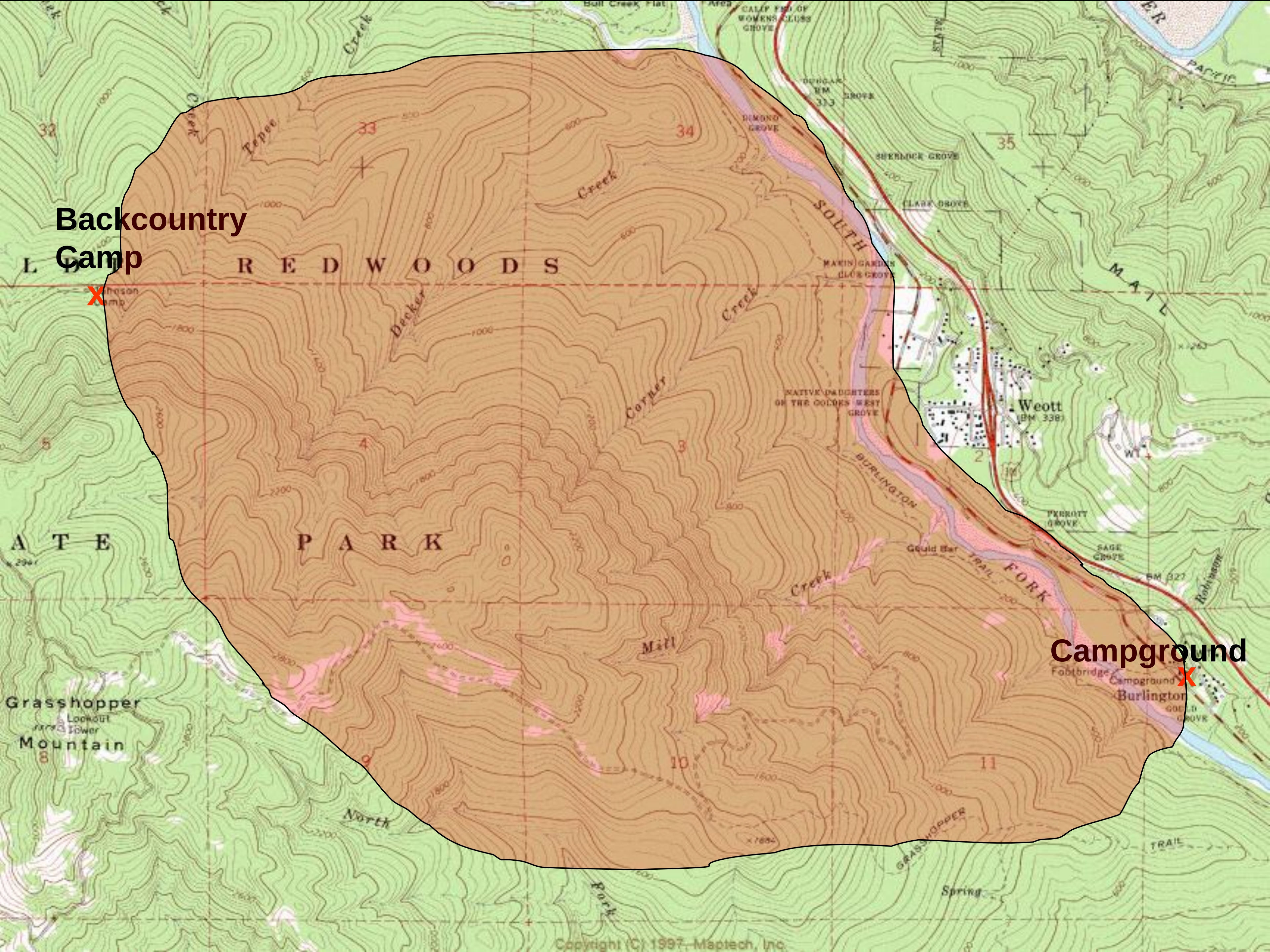
- These are the Points of Beginning and End of Your New Trail Alignment
- They Exist on All New Trail Layout
  - A Reroute Fix of Poor Trail
  - A New Trail Proposal

Trail Heads


SQUAW CANYON
LOST CANYON 1.5 MI. 2.4 KM
PEEK A BOO SPRING 3.9 MI. 6.2 KM
DRUID ARCH 7.2 MI. 11.6 KM
SQUAW FLAT CAMPGROUND 6.4 MI. 10.2 KM


Visitor Use Areas

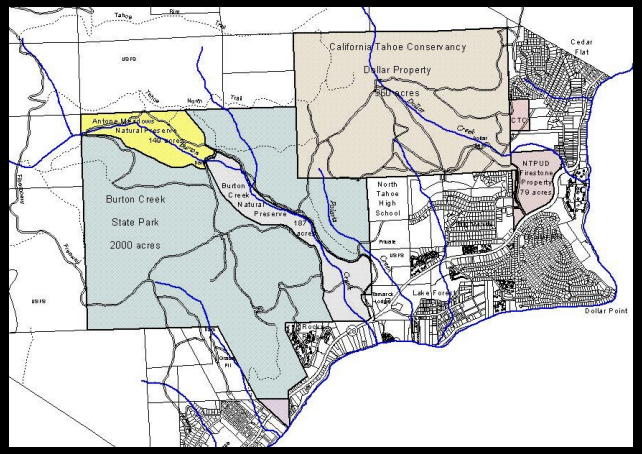
Visitor Destinations

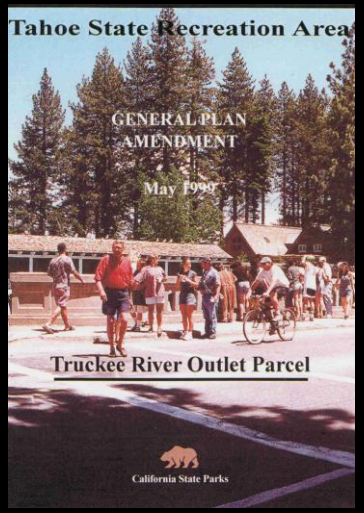

Backcountry
Camp
Campground
R E D W O O D S
P A R K
A T E
Grasshopper
Mountain
Lookout
Tower
Weott
SOUTH
FORK
BURLINGTON
Burlington
Footbridge
Campground
Gould Bar
Tepee
Decker
Corner
Creek
Mill
North
Fork
GRASSHOPPER
TRAIL
Spring
Bull Creek Flat
Copyright (C) 1997, Maptech, Inc.

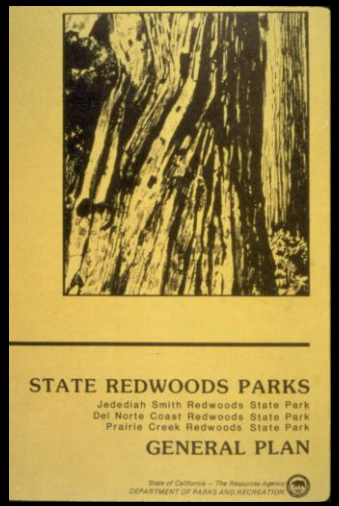
Use and Beginning and Ending Identification is Done During the Planning Process

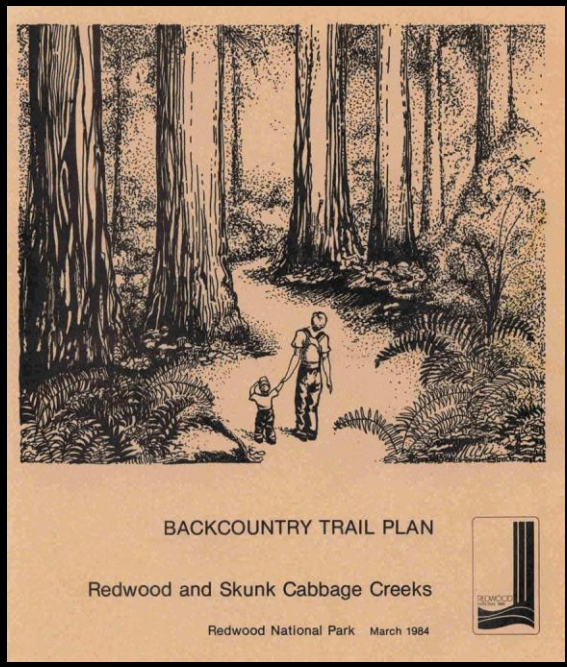
Other Planning Information is a Literature Search

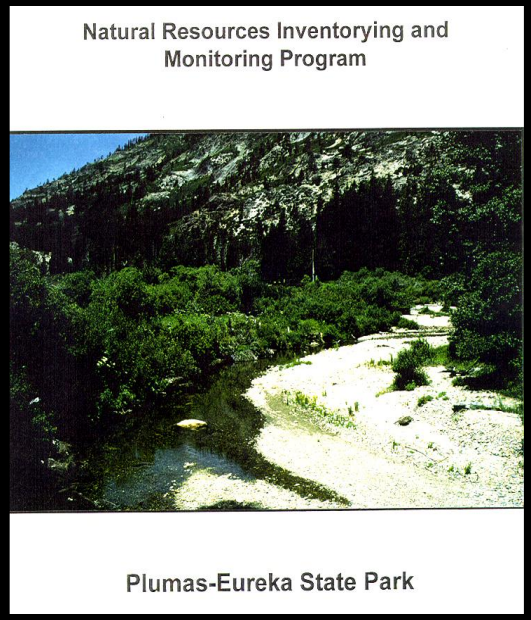
Obtain as much Background Information on the Landform as Possible

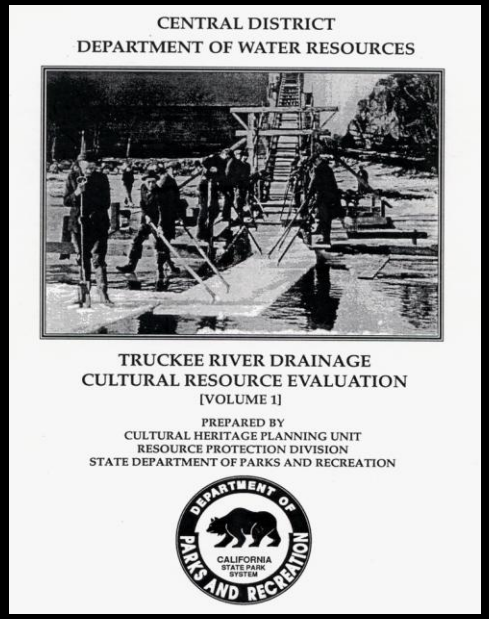


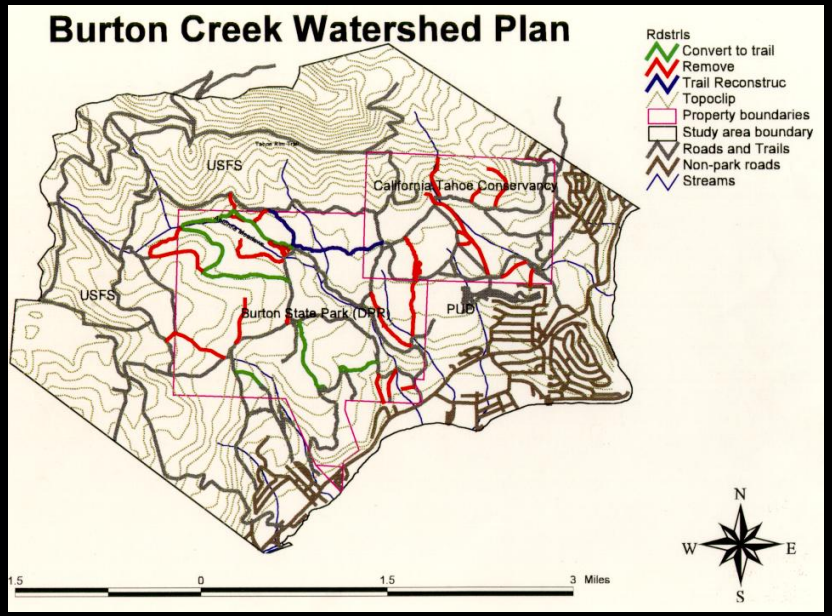


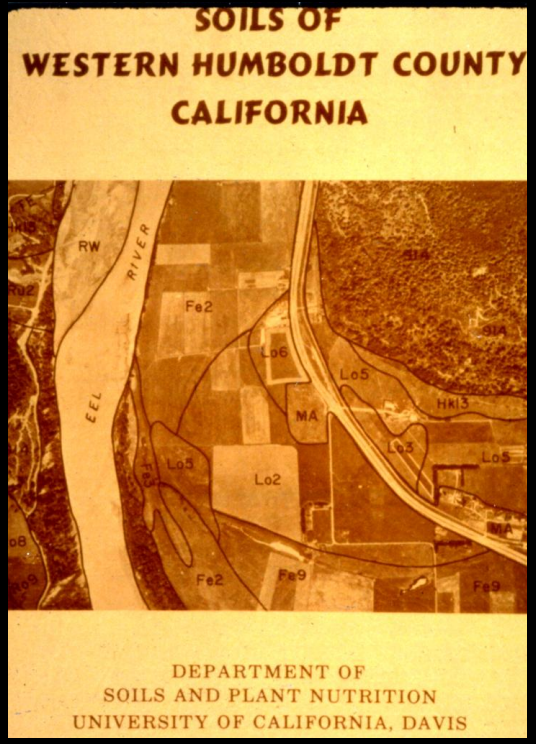


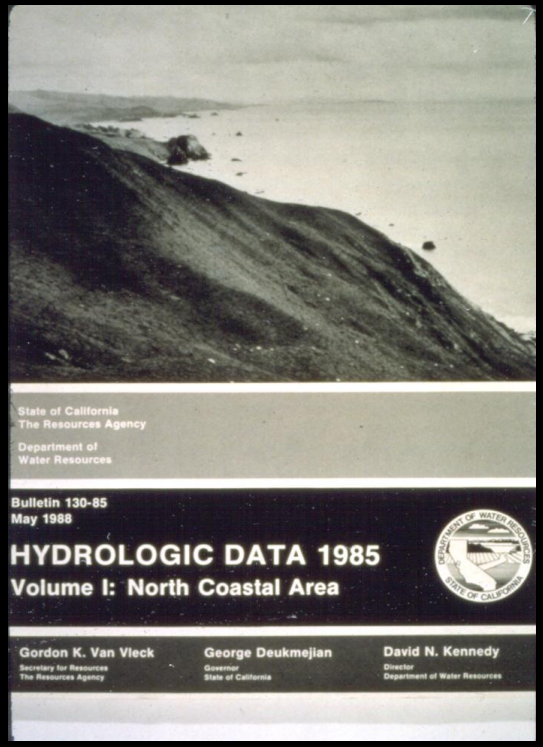


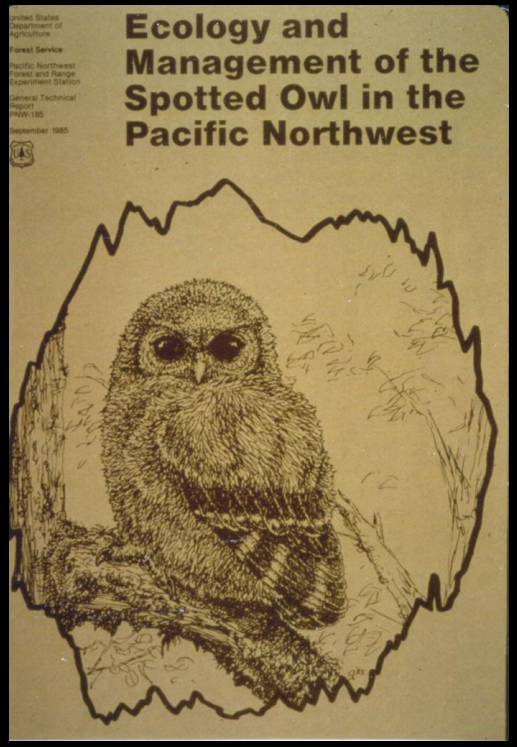


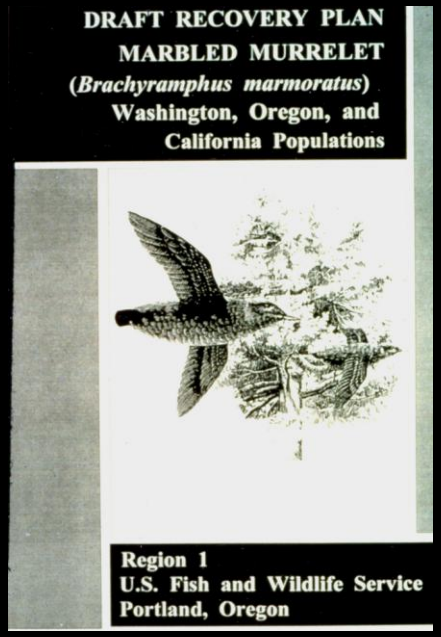


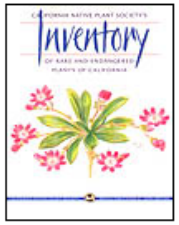












CNPS Inventory of Rare and Endangered Vascular Plants of California - 6th Edition
Rare Plant Scientific Advisory Committee

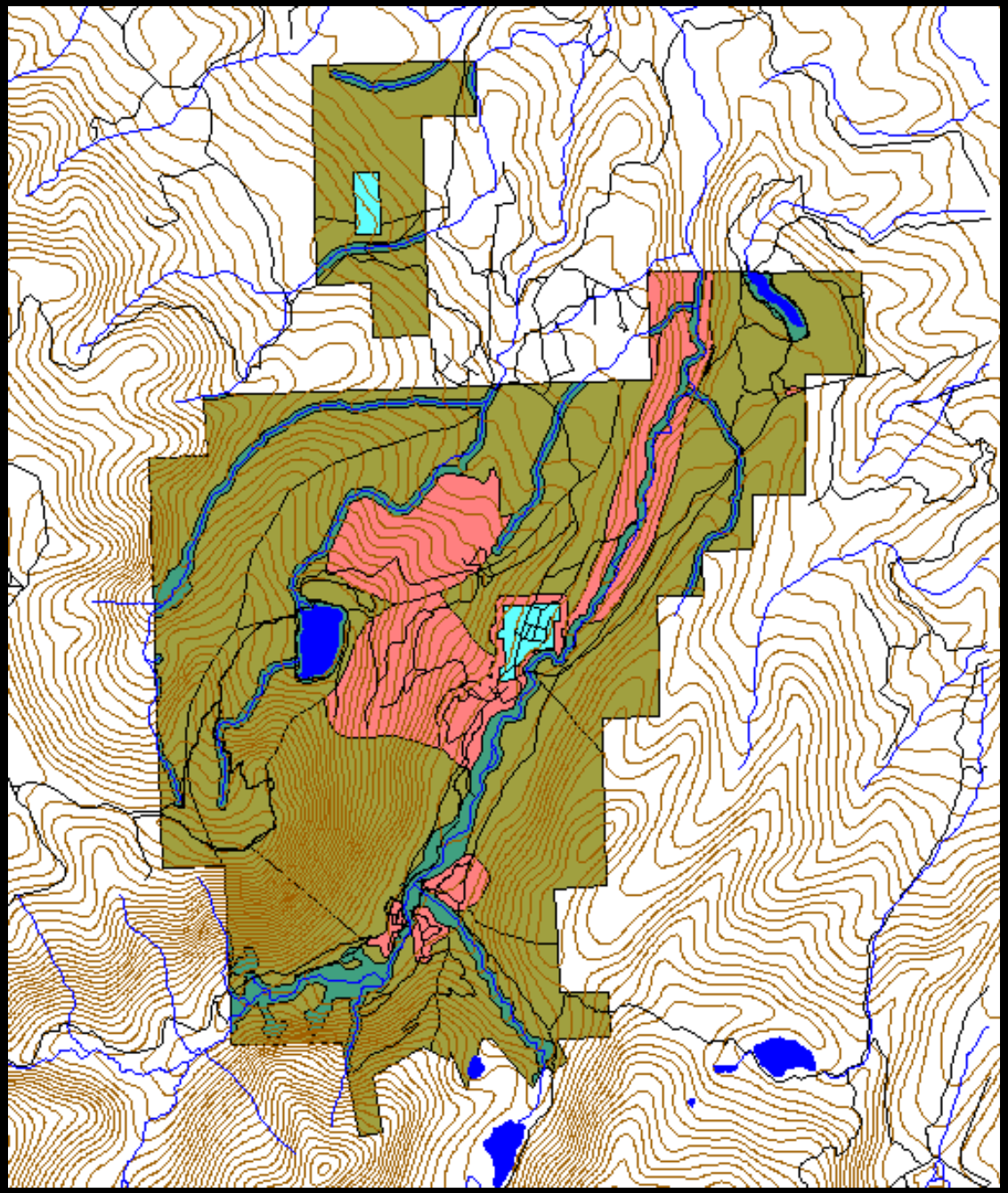
The definitive book on rare and endangered plants in California.

2001 CNPS Press. 386 pages, 8½"x11", includes line drawings, 7 appendices including plants by county, plants by common name, plants by family, and new to this edition. ISBN 0-943460-40-9 $29.95 softcover

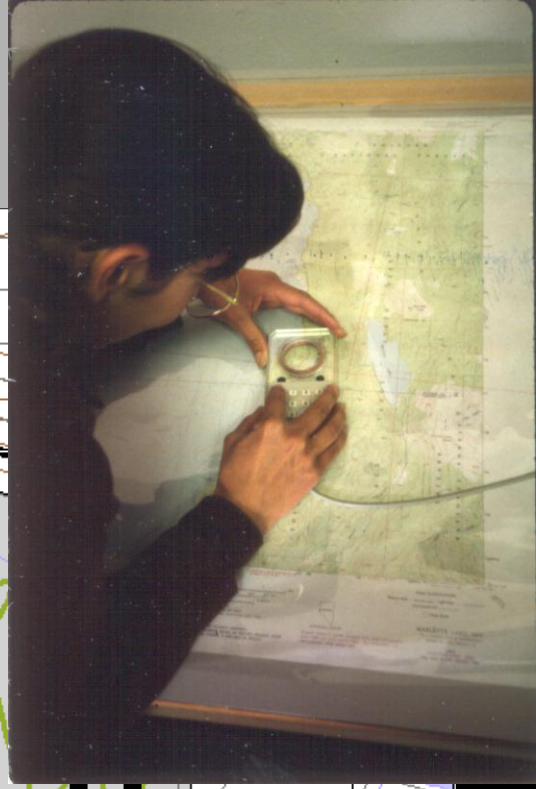
CNPS Electronic Inventory - Electronic Format

The Electronic Inventory now contains data from the 6th Edition of the CNPS *Inventory*. Users can now view the most current version of the CNPS Inventory of Rare and Endangered Vascular Plants, and search for plants based on hundreds of specific criteria. This applications is available for MS-DOS compatible systems only and requires 11 megabytes of hard disk space. Includes 3½" diskettes and manual.

Geographic Information Systems Maps



Research Cooperating Agencies GIS Data Bases



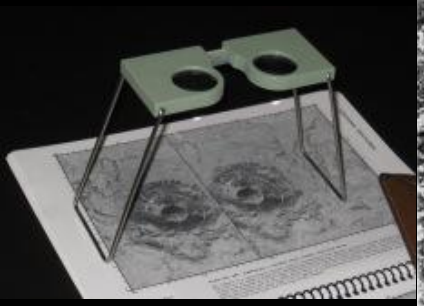
- Rdtrlpts
- Facilities
  - MUSEUM
  - KIOSK
  - BLDG COMBINATION
  - BLDG COMF
  - CAMPFIRE CENTER
  - DISABLED COMF
- ROUTE: Trails
- ROUTE: Roads
- Highway 80
- Linear Features
- Railroad
- Topography, 40ft Contour
- Streams
- Lakes
- Ownership
  - California State Parks

Donner Lake

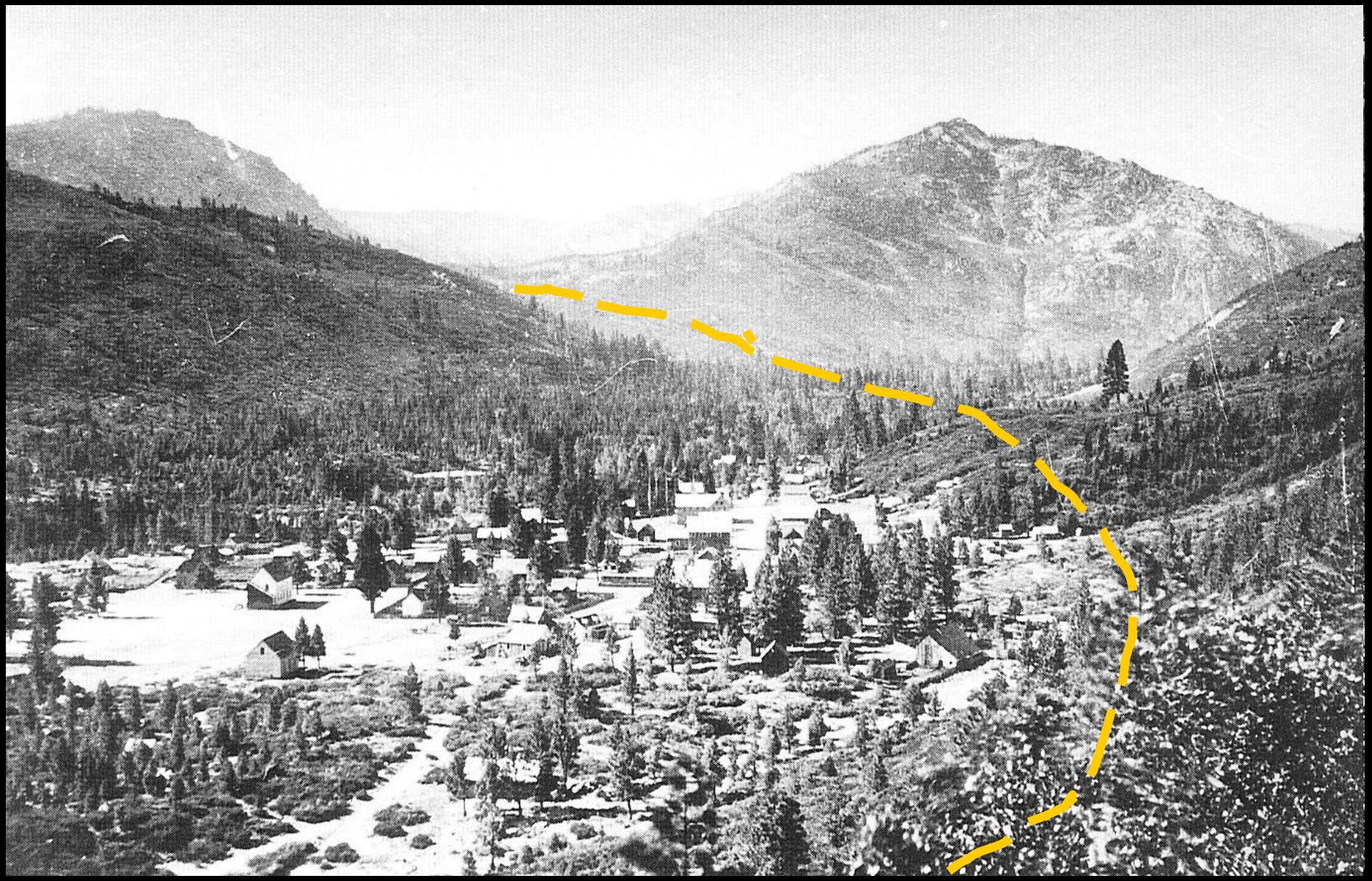
80

Origin: (738,243.38, 4,355,603.50) m Extent: (856.55, 756.56) m Area: 648,035.05 sq m

Start | Microsoft PowerPoint... | ArcView GIS Vers... | Microsoft Excel - Mus... | 4:12 PM

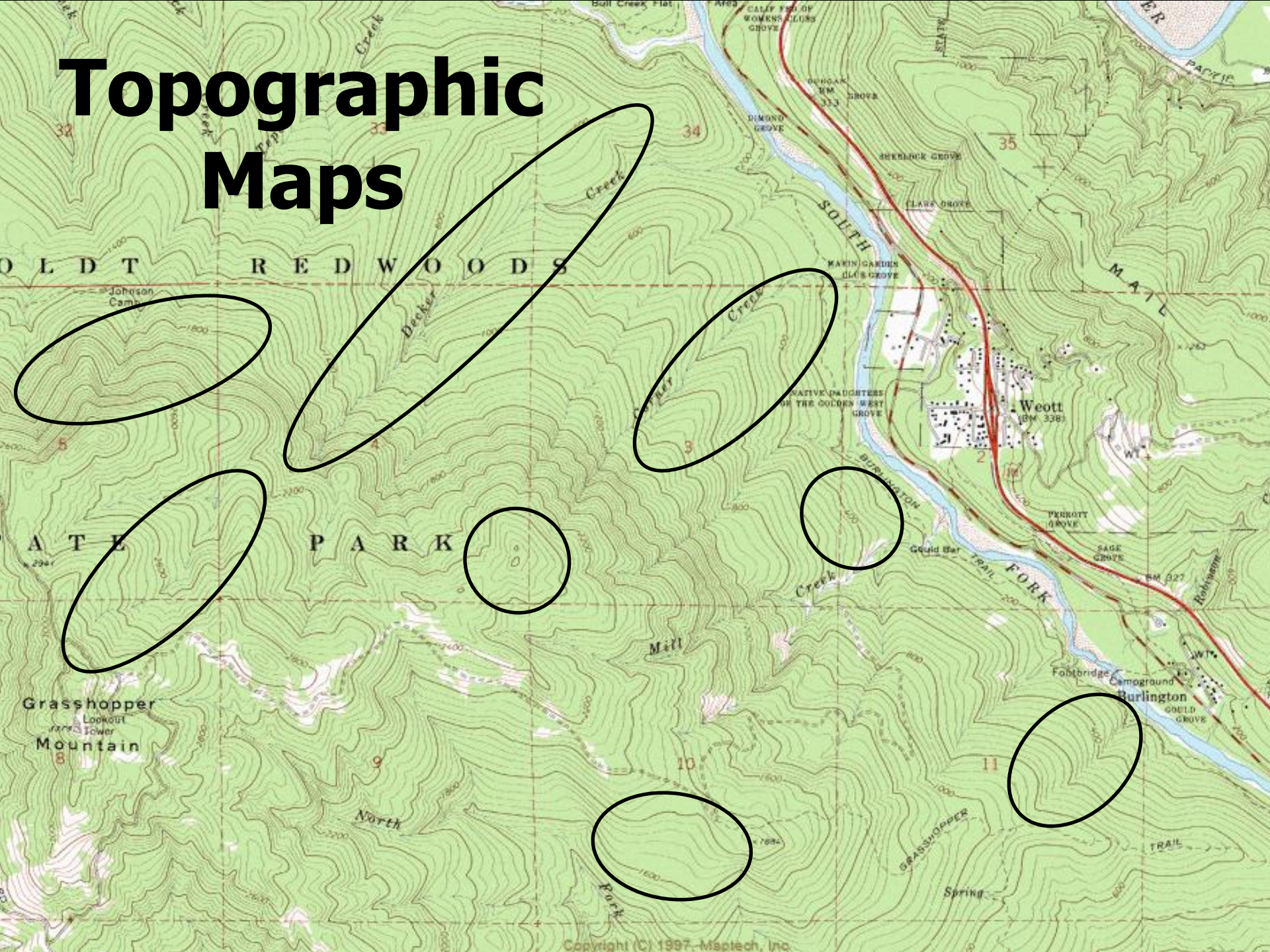


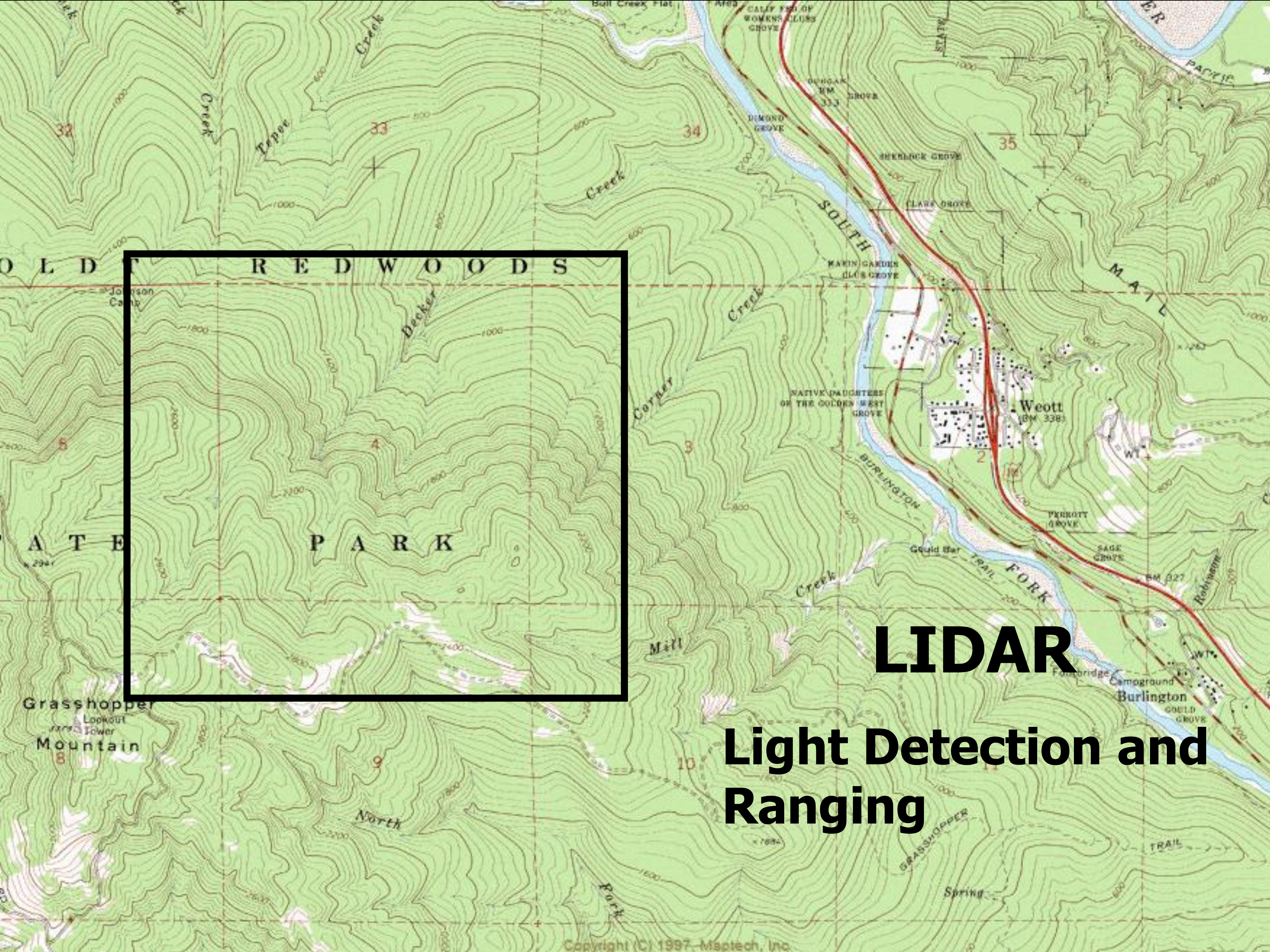

SHEET #1/3
SHEET #2/3
Structured Fill
around rock outcrop
Structured Fill
along trail slope
USFS Property
DPR Property
PROPOSED TRAIL ALIGNMENT
Existing walkway
Existing Culvert
Existing old road way
SHEET #3/3



Historic Photographs

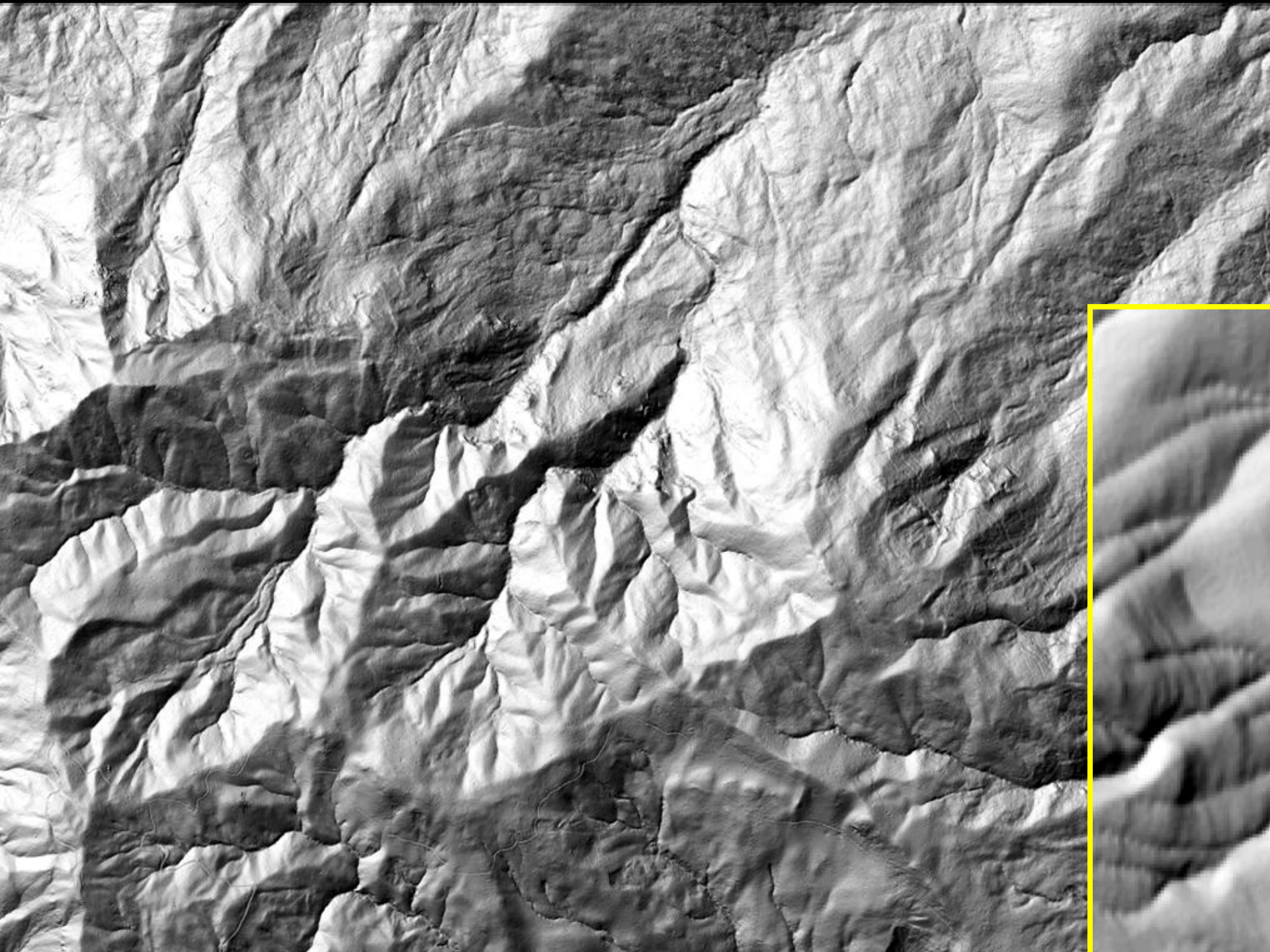
Topographic Maps





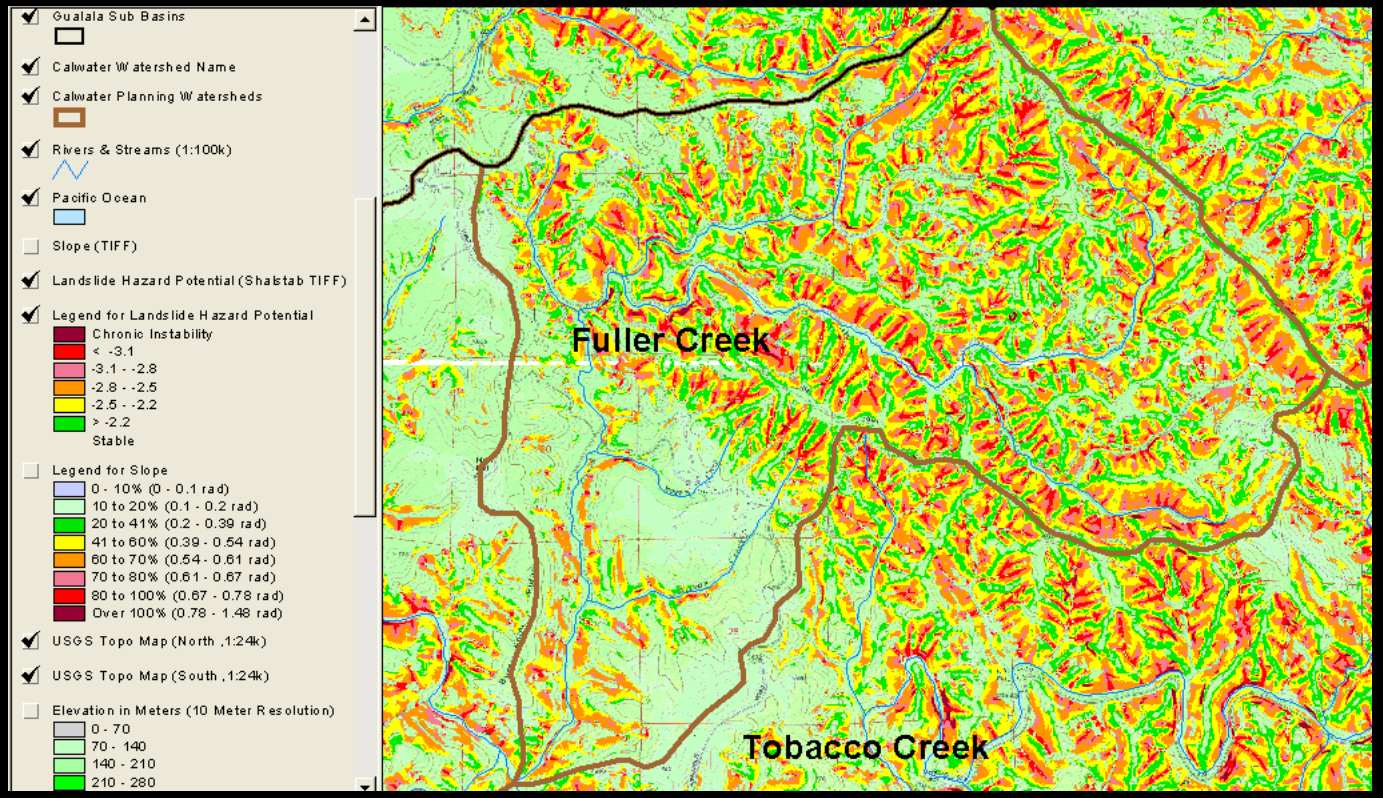
LIDAR

Light Detection and Ranging



SHALSTAB

- A digital mapping program that takes into account both the concentration of water as it flows downhill and the steepness of slopes. The model predicts the locations of highest risk of slope failures.



Literature Search Allows for a Detail Corridor Alignment

- Knowledge of the Land Increases
- Establish Connectivity with Adjoining Land Managers
- Identify Sensitive Areas to Stay Away From
- Knowledge of Land Capability Limitations
- Major Control Points Begin to be Identified

Further Corridor Work Before Going Into Field

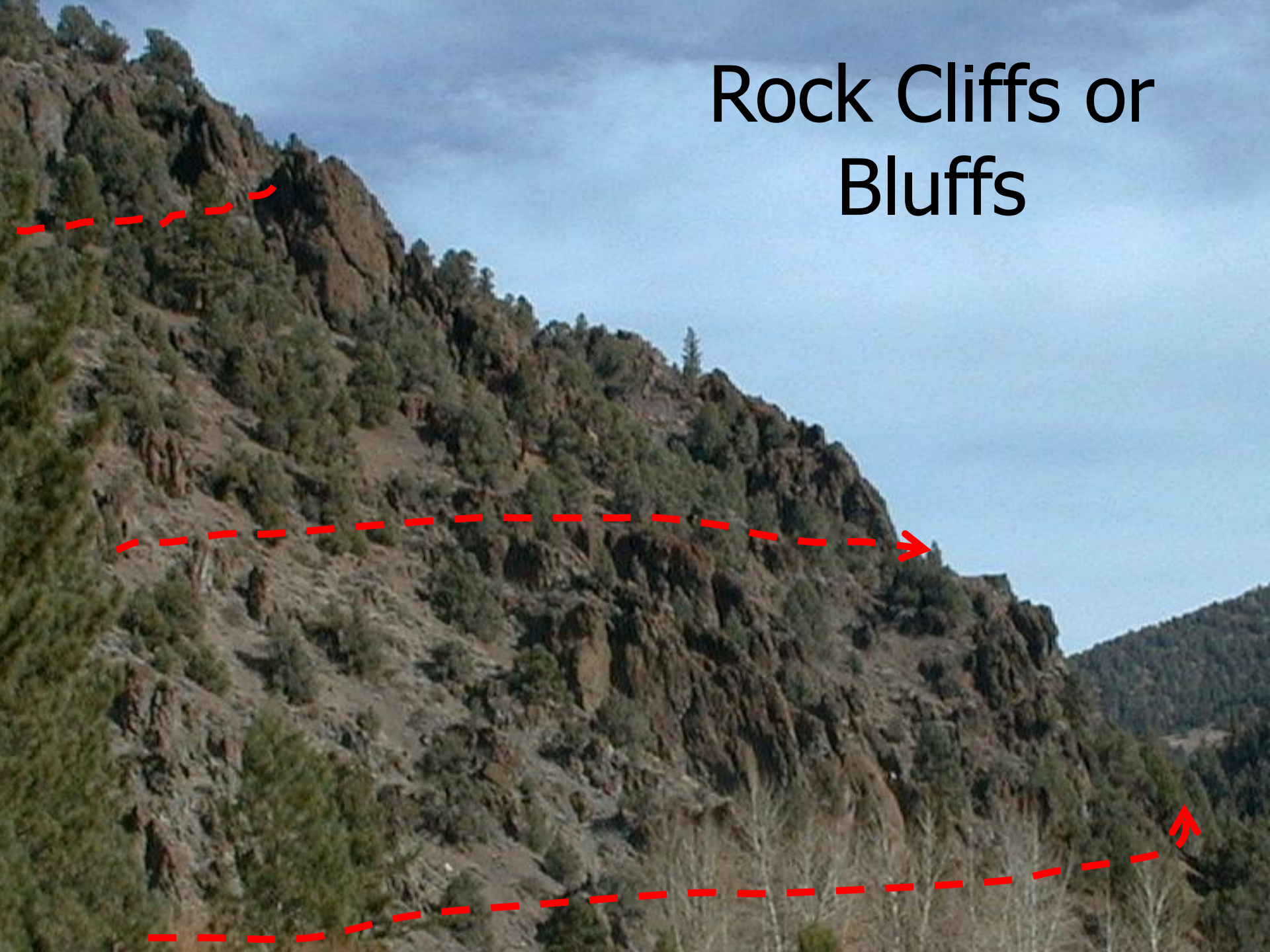
- Identify Major Control Points
  - These are areas that the Trail Corridor NEEDS to Go To or Miss
- Break The Trail Corridor into Smaller Units
  - Major Control Point to Major Control Point

Rivers or Bodies of Water

Large Land Slides

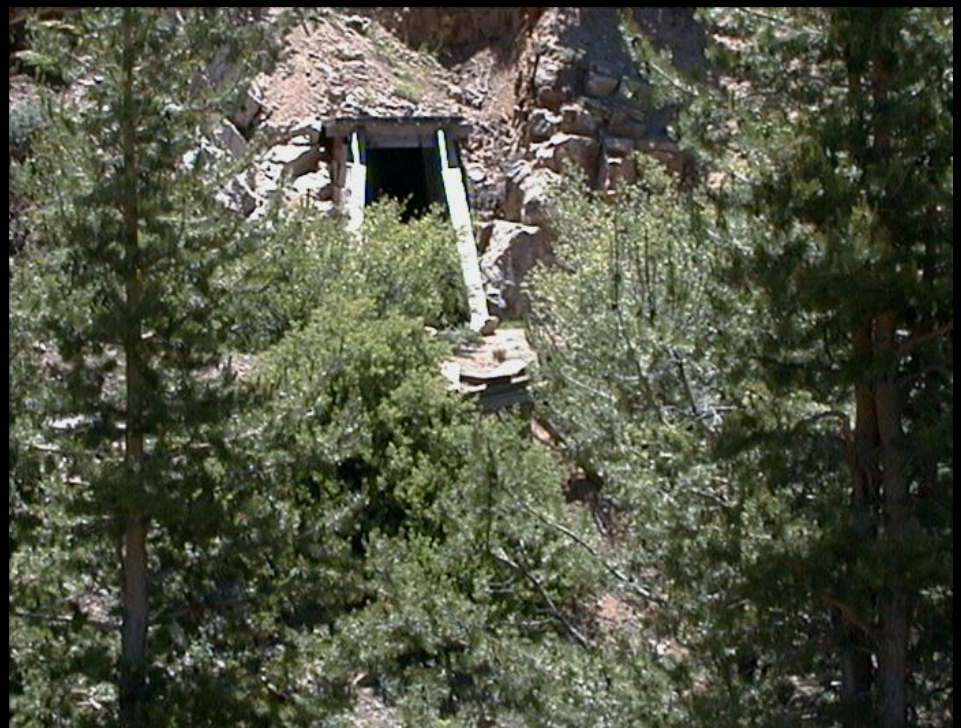
Large Areas Of Low Capability Land

Wildlife Management Areas


Rock Cliffs or
Bluffs

Gaps through Rock Formations

Pre-Contact Cultural Resources

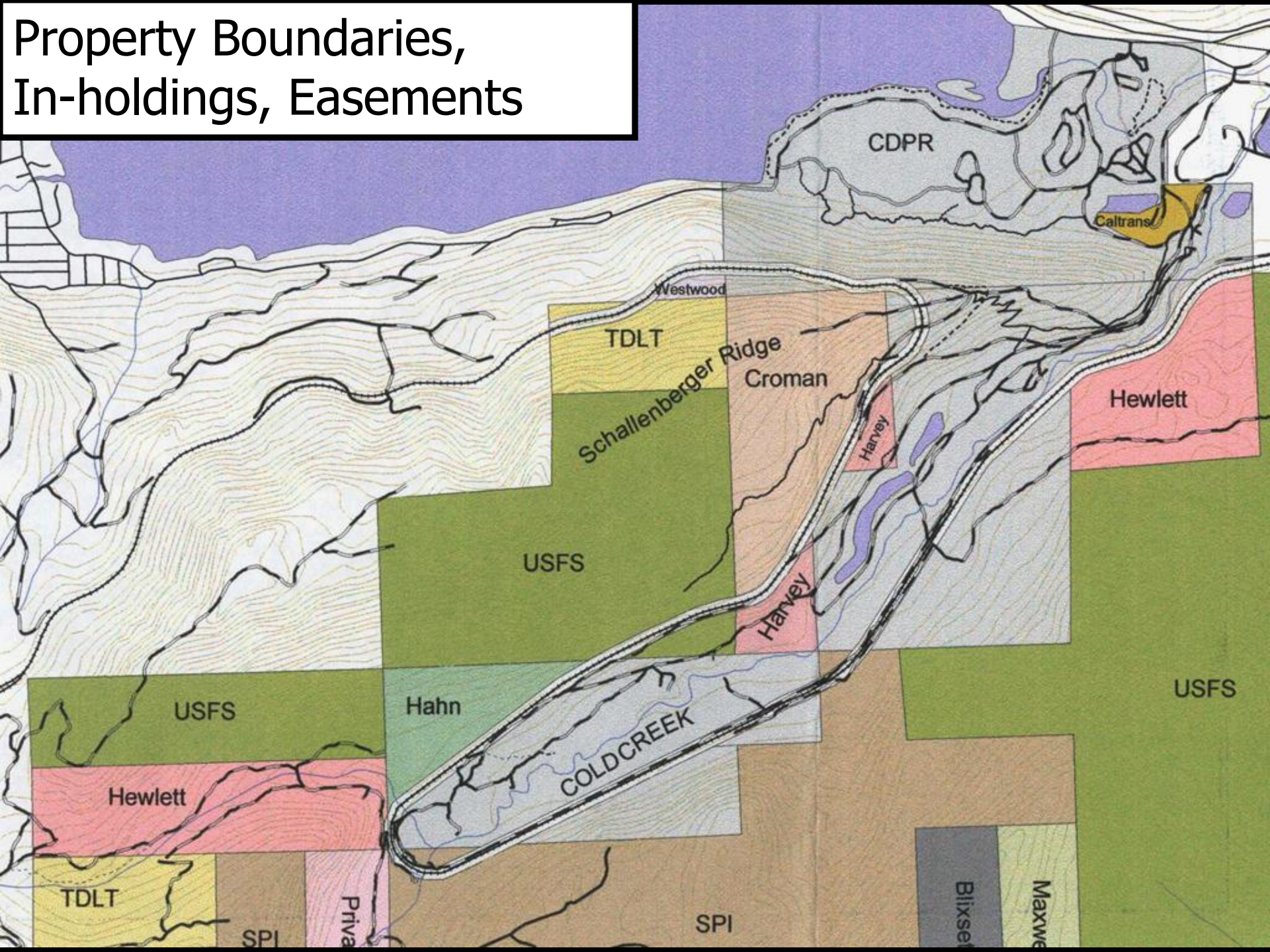


Euro-American Cultural Resources

Park Facilities or Other Areas of Special Visitor Interest

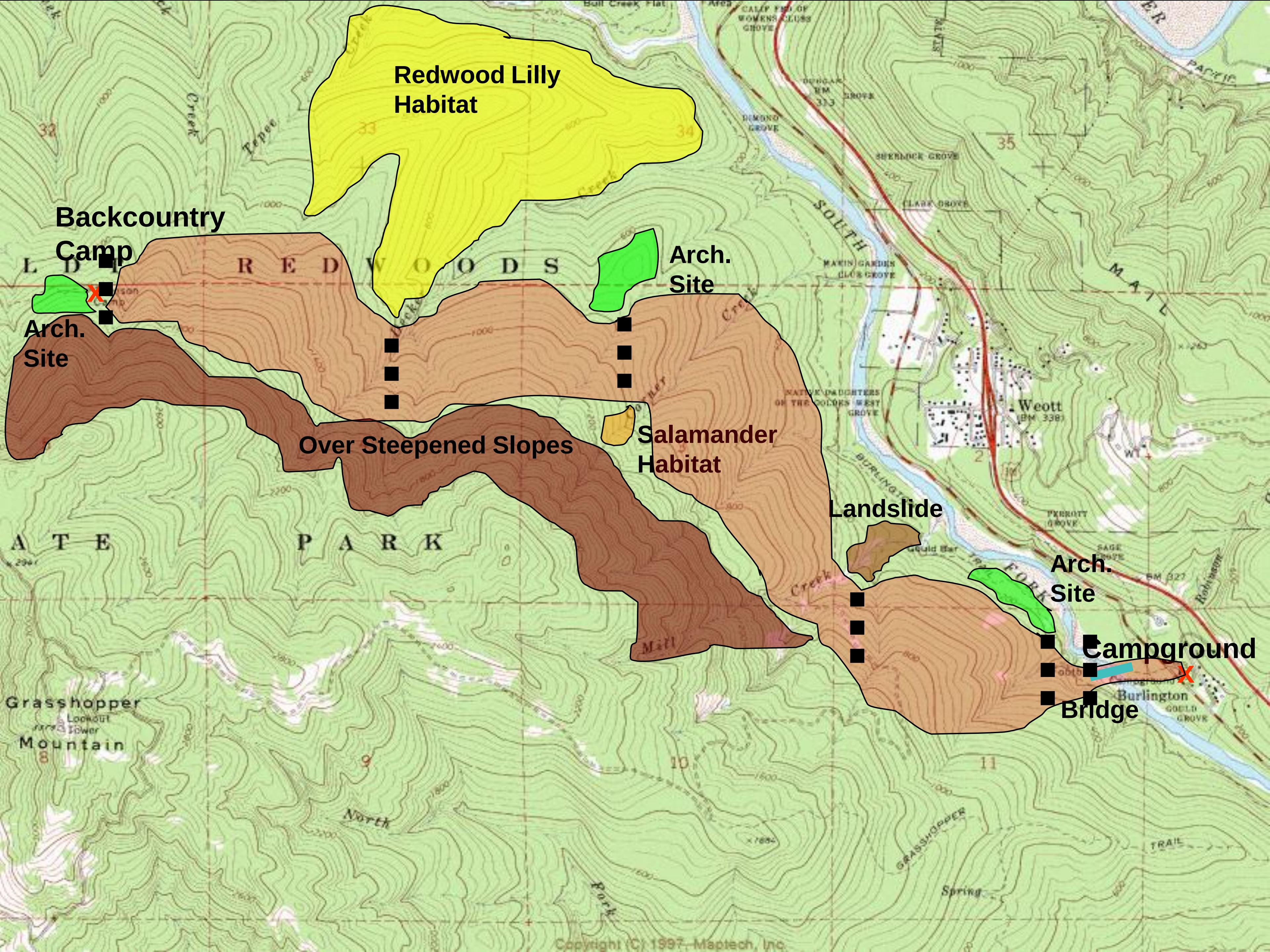
Major Road or Highway Crossings

Property Boundaries, In-holdings, Easements



Work Completed in Your Office Not the Field

- User Type
- Classification Identification
- Trail Design Standards
- Points of Destination
- Literature Research
- Major Control Point Identification
- Trail Corridor Alignment (on paper)


Redwood Lilly
Habitat
Backcountry
Camp
Arch.
Site
Arch.
Site
Over Steepened Slopes
Salamander
Habitat
Landslide
Arch.
Site
Campground
Bridge
R E D W O O D S
A T E
P A R K
Weott
Grasshopper
Lookout
Tower
Mountain
Burlington
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Get the Big Picture

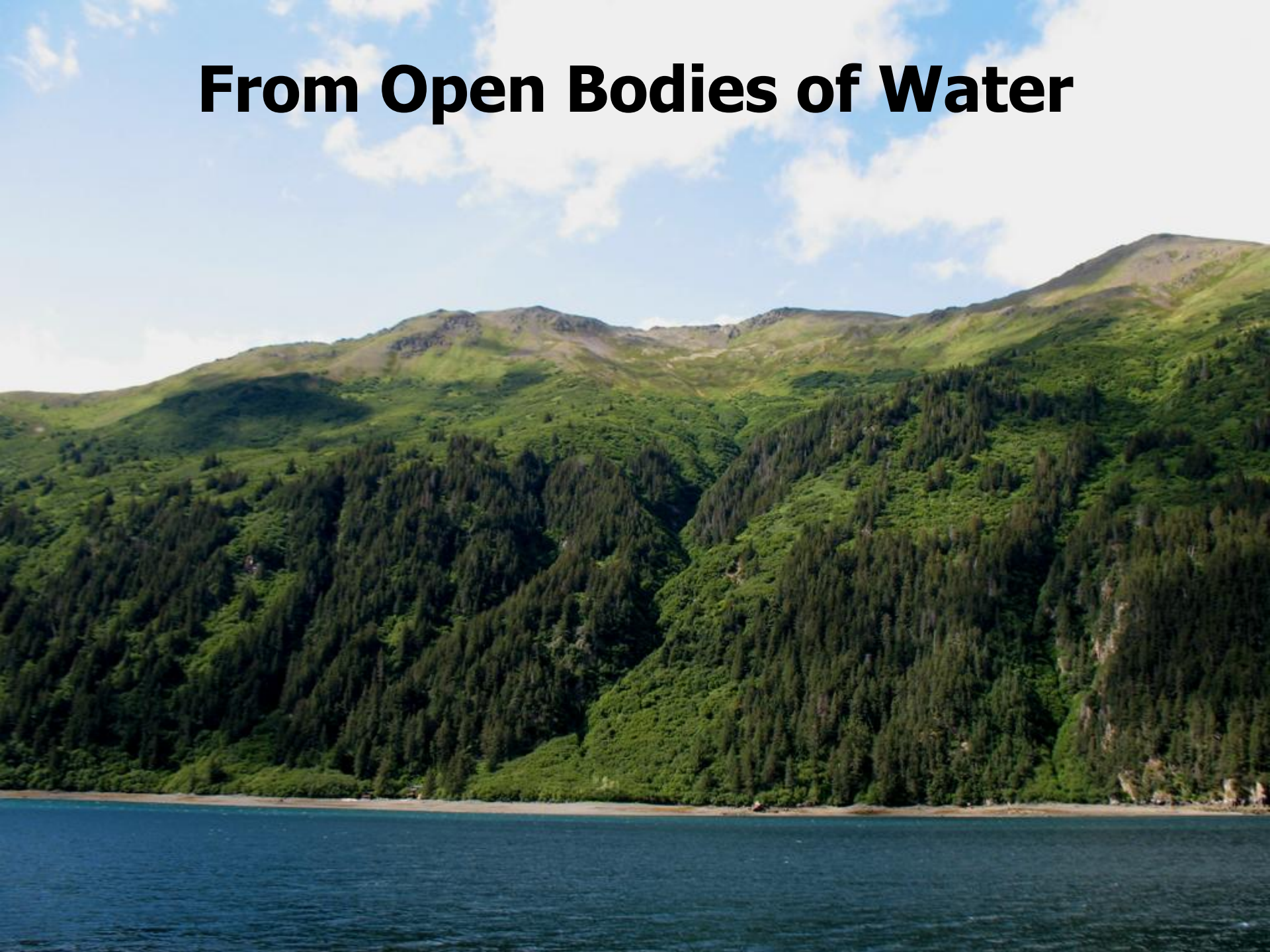
Try to get a High Visual Overview of the Shorter Corridor Unit

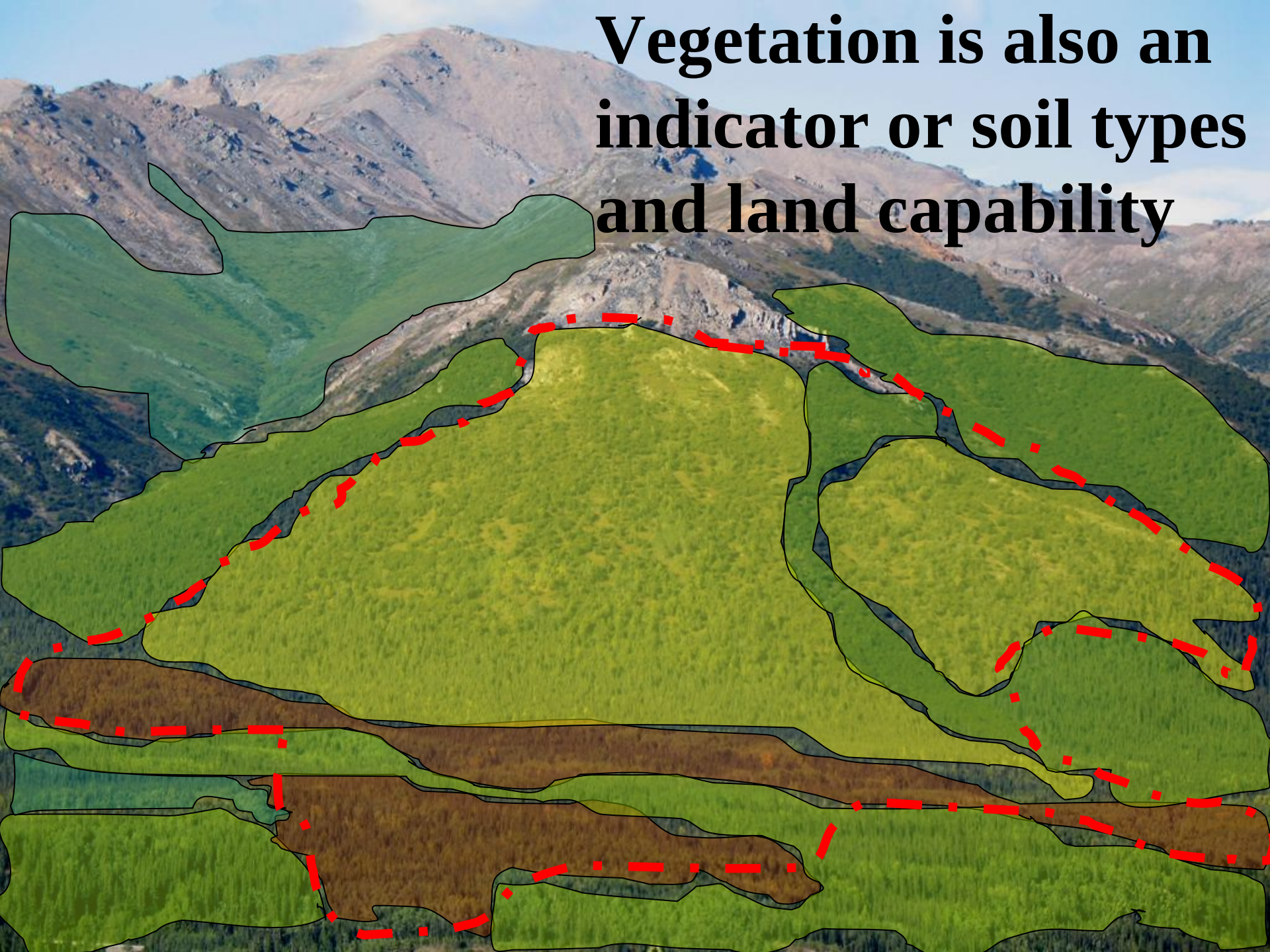
Helicopter

- Fire Agency
- Coast Guard

High Prominent Ridges, Lookouts

From Open Bodies of Water




Vegetation is also an indicator or soil types and land capability


Google Earth
File Edit View Add Tools Help
Fly To
Local Search
Directions
e.g. 94043
Places
BBS layer in the Layers Panel
Imperial Palace, Tokyo, Ja
n
Enable the Keyhole Communit
BBS layer in the Layers Panel
Canadian Supreme Court
Enable the Keyhole Communit
BBS layer in the Layers Panel
default
Google Earth default view.
Edit/Snapshot a new view to chang
Temporary Places
Layers
Layers
terrain
National Geographic Magazi
Google Earth Community
Community Showcase
Google Earth Community (Un
nked)
Dining
Lodging
Banks/ATMs
Bars/Clubs
Coffee Shops
Pointer 35°58'37.61" N 115°26'29.15" W elev 4612 ft
Streaming 100%
Eye alt 21847 ft
Lodging
Dining
Google
http://earth.google.com/
Start
2 Windows Expl...
Microsoft PowerPoi...
Google Earth
Desktop
3:05 PM

Get a Good Visual Survey of the Land Before You Jump into the Brush

Reconnaissance

Ground Checking the Trail Corridor Identified

Identification of Minor Control Points

Reconnaissance Process Occurs Between Major Control Points

Reconnaissance

It Can Be Much Easier to Perform Reconnaissance in Winter Months

Minor Control Points

- Identified During the Reconnaissance Process
- Features in the Trail Corridor that will Influence the Alignment of the Trail
- Discovered and Worked Around During On-the-Ground Reconnaissance

Rock Outcrops

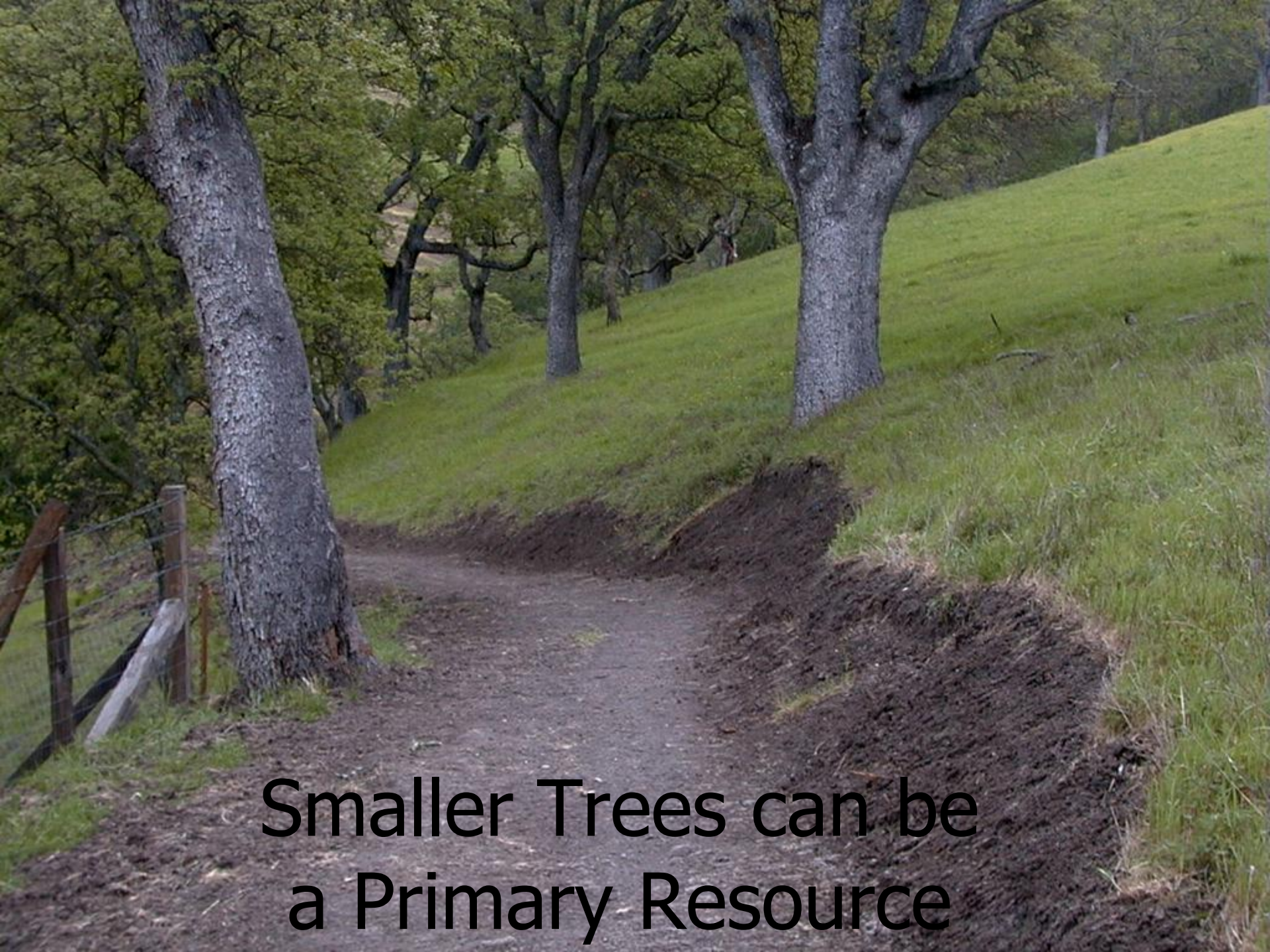

Rock Outcrops

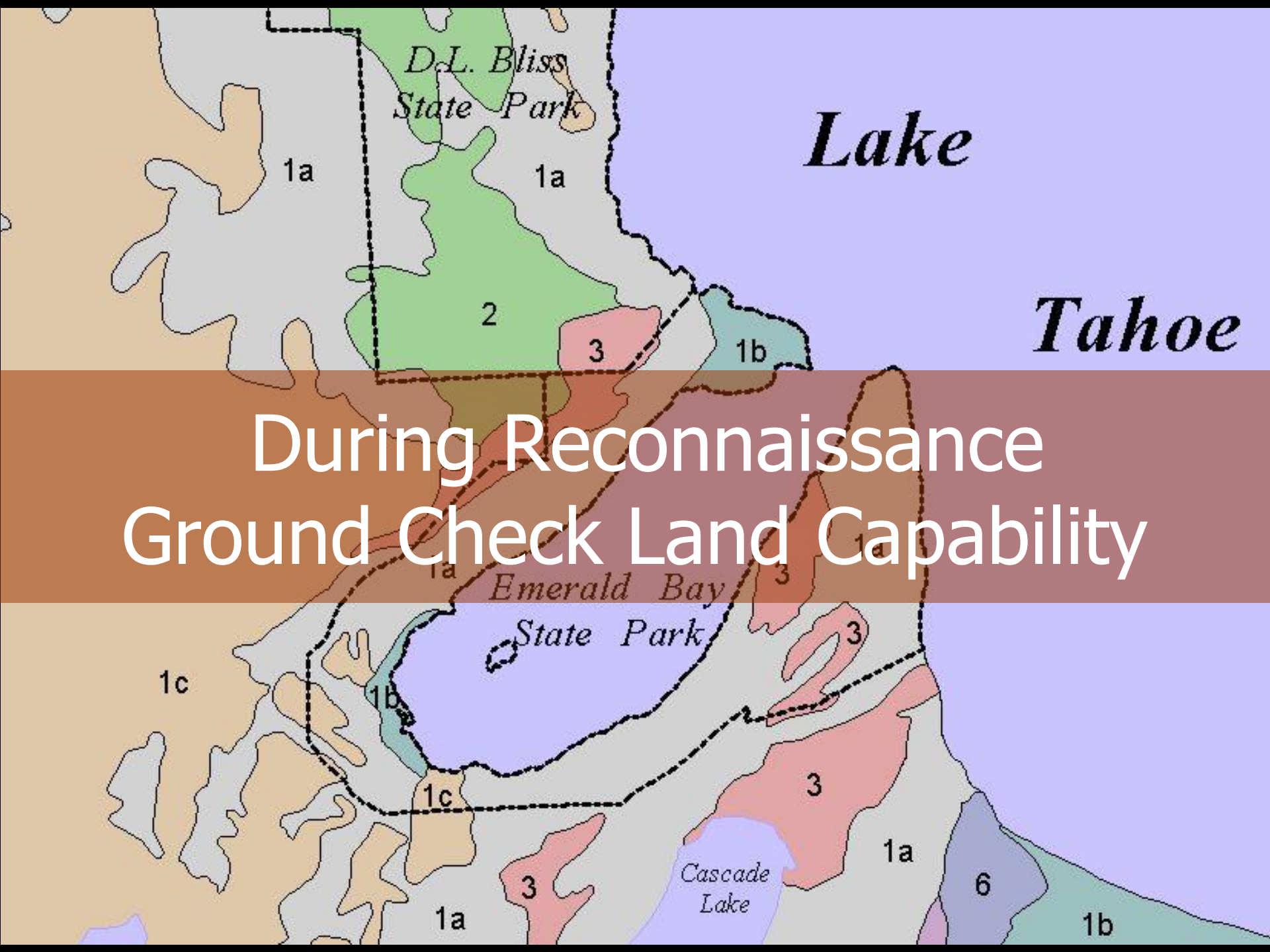
Stream Crossings

Fully Investigate for Proper Trail Alignment

Esta ows

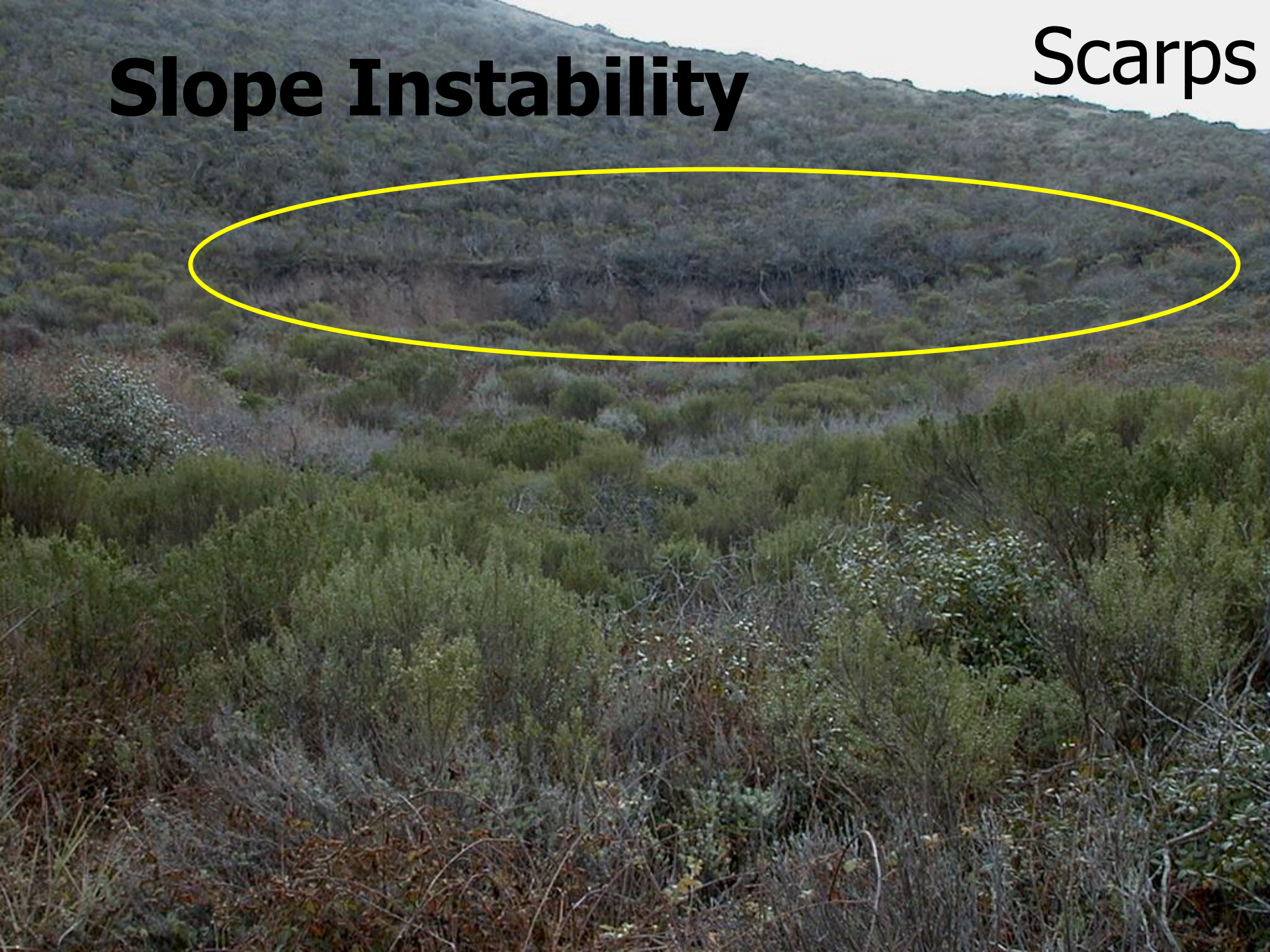
Large Trees are Minor Controls


Smaller Trees can be
a Primary Resource



During Reconnaissance Ground Check Land Capability

Slope Instability




Debris
Flows

Sometimes Obvious

Look Hard
Vegetation Hides Old Slides

Be Leary of Standing/Ponding Water

Pistol Grip Trees

Tilted Trees

Open Canopy

Land Capability Soils

Soils Range From Rock to Sand

Sandy Soils Appear Stable

Clay and Silt Deposits

Clay Soils Lose Structure with Moisture

River Gravel Deposits

- Contain Better Matrix of Material Size, Rock, Some Silts and Less Clays
- River Gravels Have Better Sustainability
- River Run Parent Gravels are Missing Fractured Faces for Locking

Angular Fractured Rock

Shales

Good Material Matrix

A Good Material Matrix

Will Compact and Keep Soil Moisture Content

Sustains Grade and Heavy Use

While Traversing the Corridor Be Noting These Other Features

Wetlands-Sensitive Areas

Indicator Species

Each Area has Species that Indicate Wet/Saturated Habitat

Identify these during your Reconnaissance

Slope and Aspect

South Aspect

Effects Snow Melt, Shade, Vegetation

North Aspect

Vistas and Views


Take advantage of viewsheds within your corridor

Aesthetics

Design in Visitor Attraction Areas

Flowering Native Plant Species


Specimen Trees, Etc.

Wildlife Resources

Design Trail Corridor ***Away*** if Sensitive

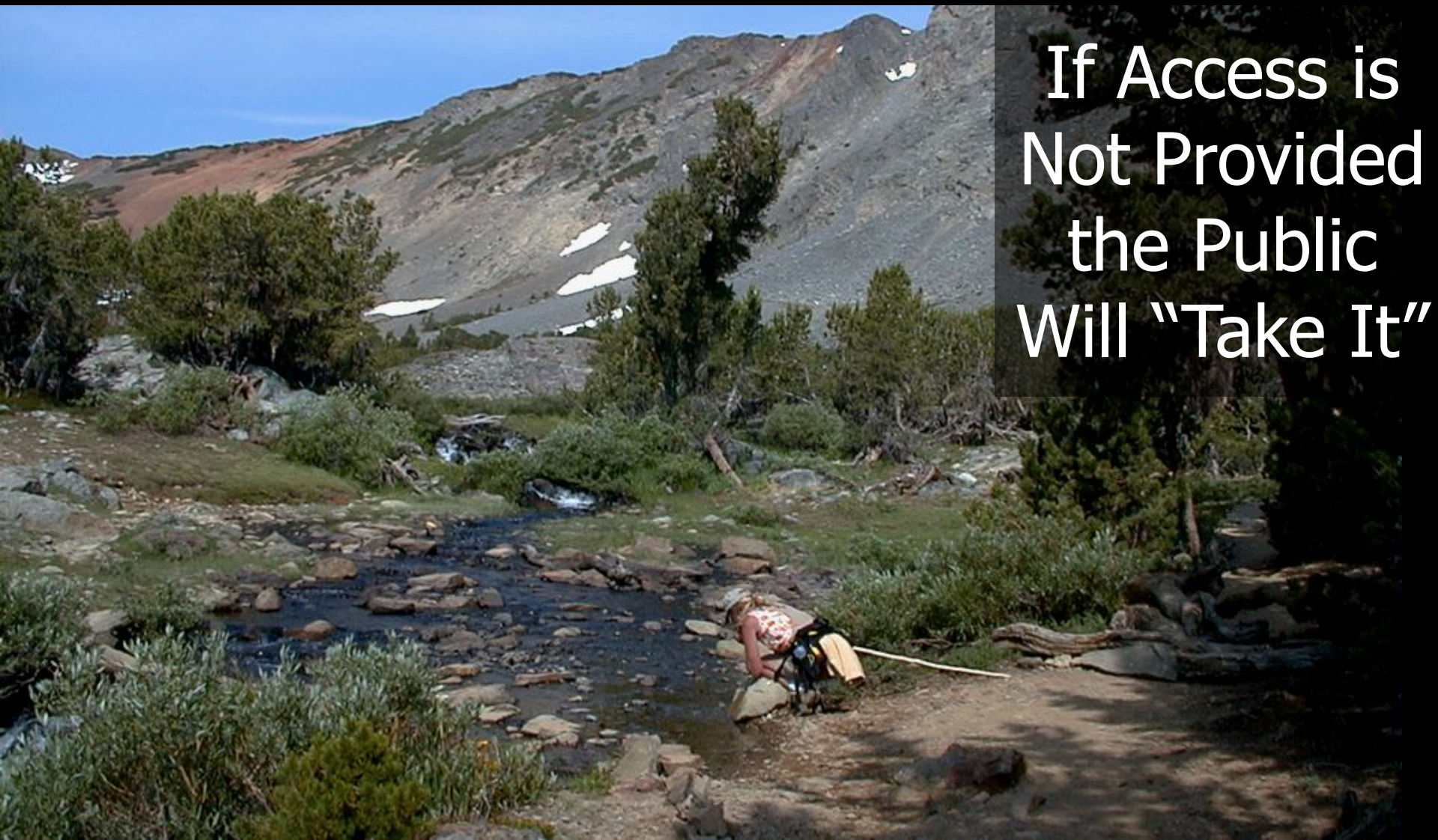
Design To, if No Impact, for Visitor Experience

Historic Resources, If Not Sensitive

They Offer the Visitor a Connection to their past


Keep Your Eye Open
for Sensitive Cultural
Resources

Studies Indicate Visitor Preference to Feel, Hear and See Water



If Access is Not Provided the Public Will "Take It"

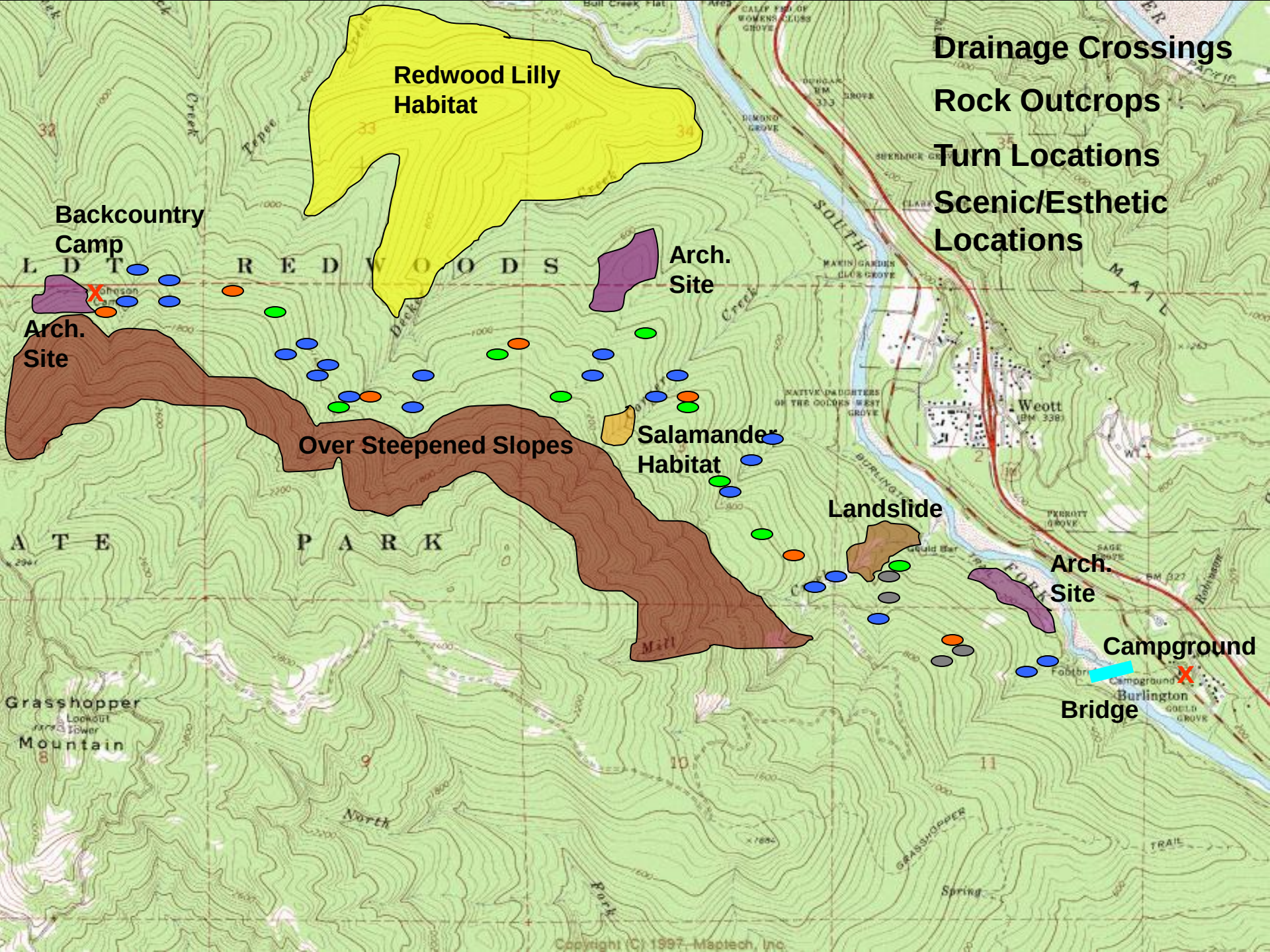
Visitor Safety

Be Conscious of Talus Slopes and Rock Fall Areas


Avalanche Slide Areas

Avoid High Wind and Lighting Prone Areas

- When You Identify Controls and Unique Features Track Them With Altimeter and Plot on Topo Map


Drainage Crossings
Rock Outcrops
Turn Locations
Scenic/Esthetic Locations
Redwood Lilly Habitat
Backcountry Camp
Arch. Site
Arch. Site
Over Steepened Slopes
Salamander Habitat
Landslide
Arch. Site
Campground
Bridge
L D T R E D W O O D S
A T E P A R K
SOUTH
Weott
Grasshopper Mountain
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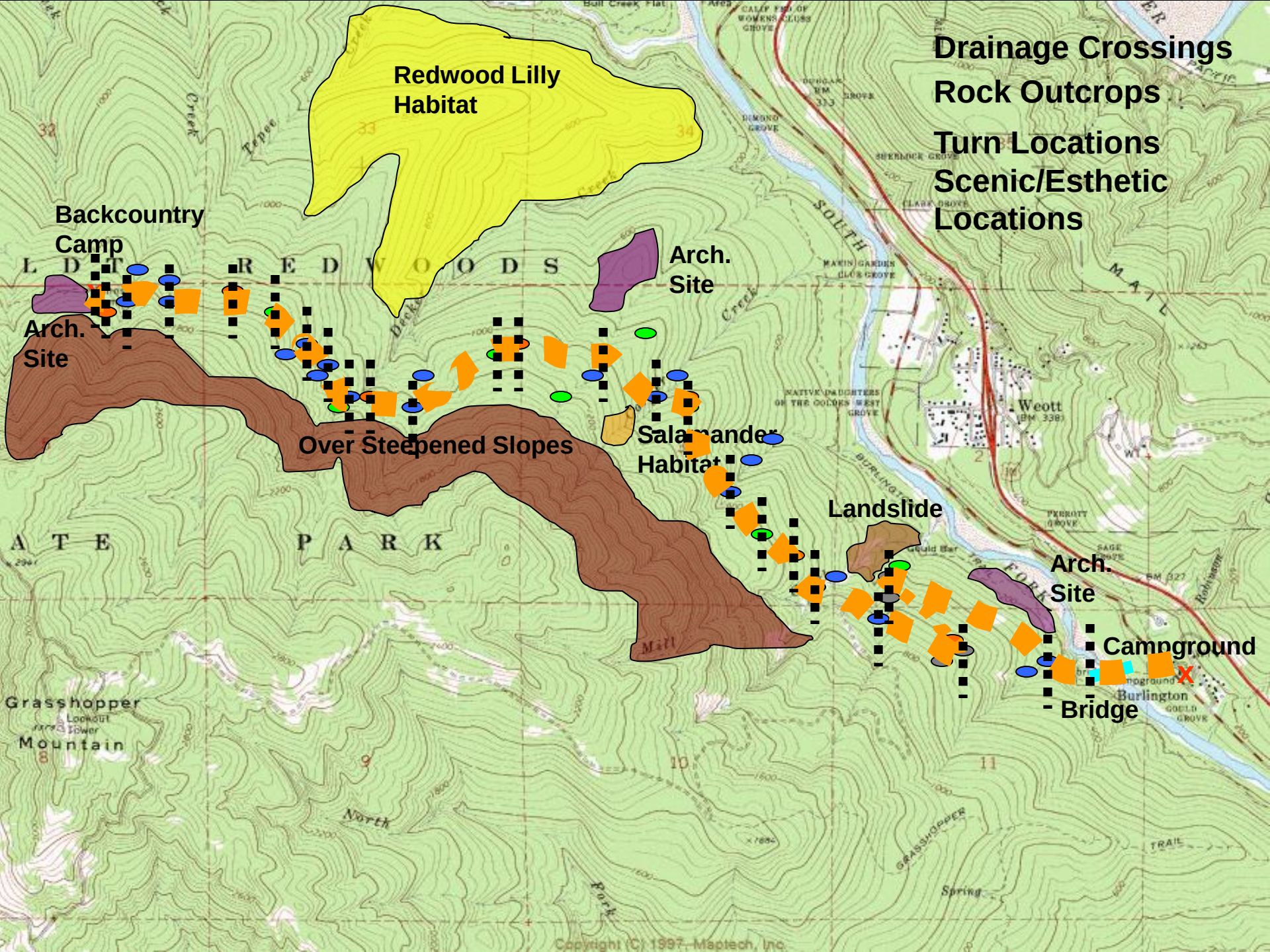
- Keep Track of Rough Grades With Clinometer
- Narrowing and Defining a Rough Trail Corridor & Breaking it Into Smaller Segments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Salamander Habitat
Landslide
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Campground
Bridge
Weott
Grasshopper Mountain
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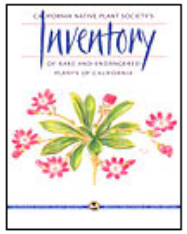
- When Your Trail Corridor Is Narrowed Sufficiently
- Get Your Resource Specialists Involved on the Ground
- Before ANY Flagging Takes Place

Consultation and Surveys on Sensitive, Threatened and Endangered Wildlife Species and Plants



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Rare Plant Scientific Advisory Committee

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Hydrologist Review of Stream Crossings


Archaeologist
Cultural Survey
of Corridor
Alignment

Sustainable Trail Design Conclusion

- Establish User Type
- Classify and Establish Standards
- Perform Literature Search
- Identify Major Control Points
- Establish Broad Corridor Alignment
- Perform Big Picture Overview
- Field Check by Reconnaissance
- Establish Minor Control Points

Sustainable Trail Design Conclusion

- Assess Land Capabilities
- Take Advantage of Inherent Aesthetics
- Identify Safety Concerns
- Rough Map Control Points and Trail Corridor
- Bring In Resource Specialists for Review Before Laying a Flagged Alignment
- Now Final Alignment Identification Can Begin